ELECTRICAL REVIEW 3 JUNE 1960

POWER CONVENTION REPORT

ELECTRICAL REVIEW

FRIDAY
3 JUNE 1960

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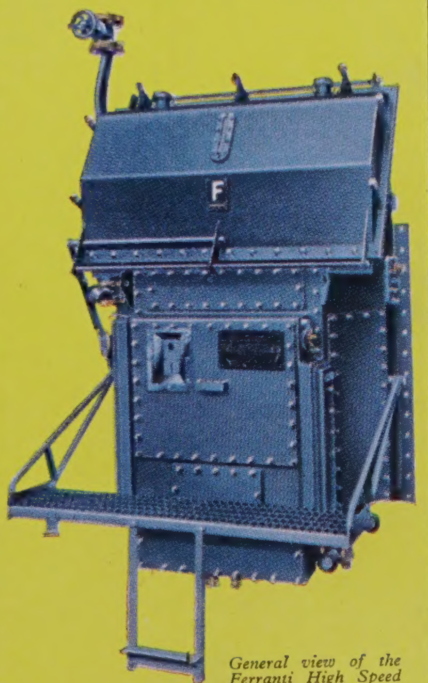

General view of the Ferranti High Speed Resistor On-Load Tap Changer Type D.C.3.

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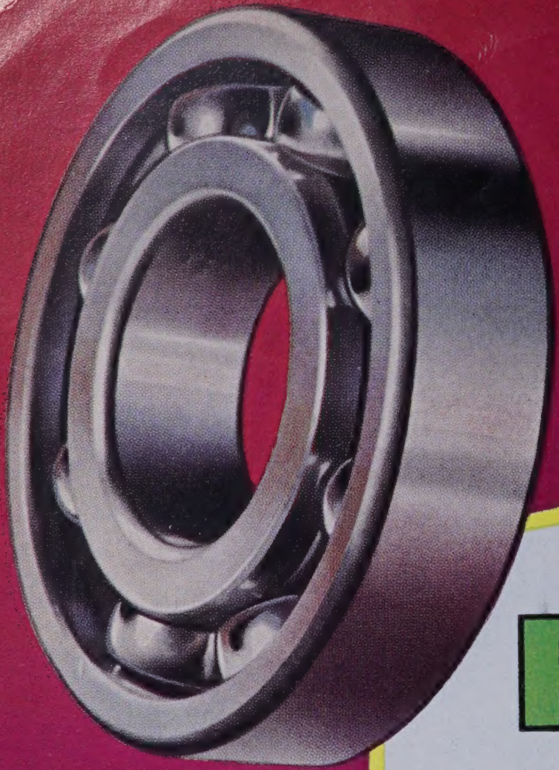

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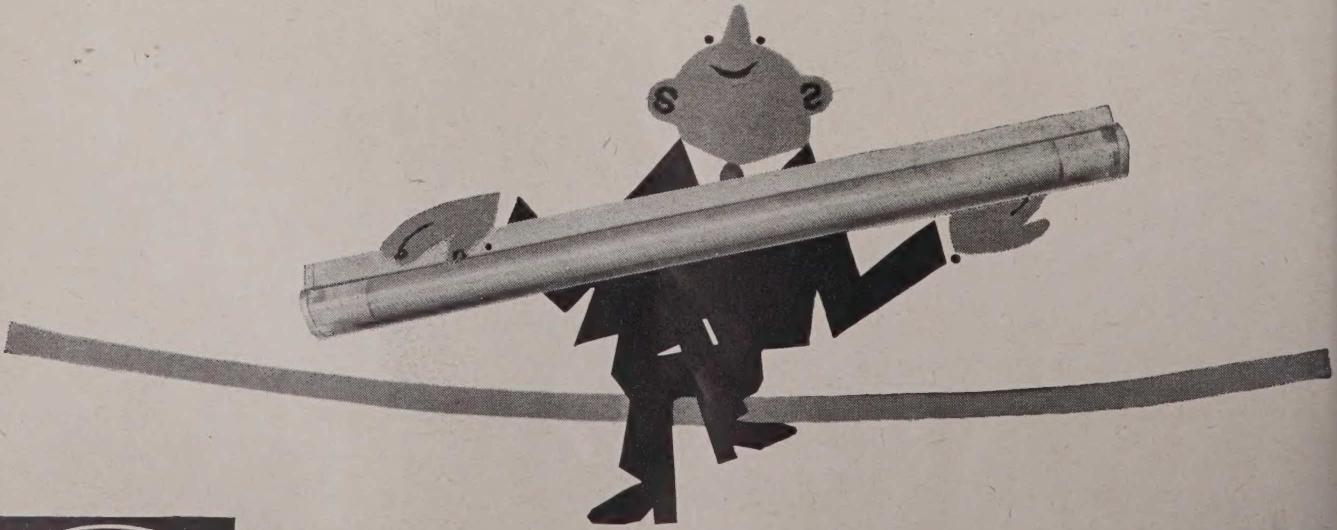

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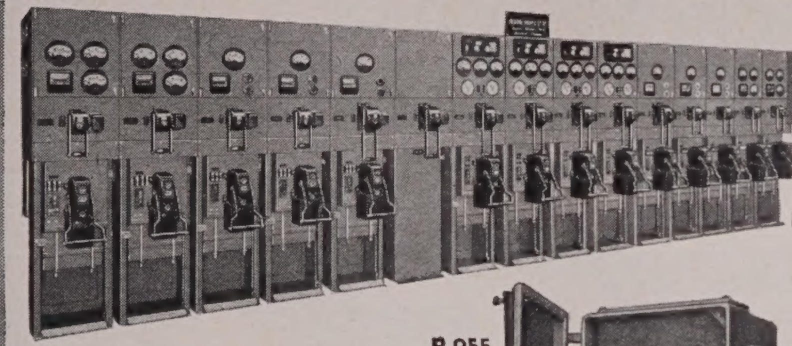
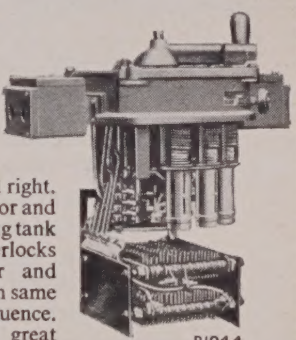
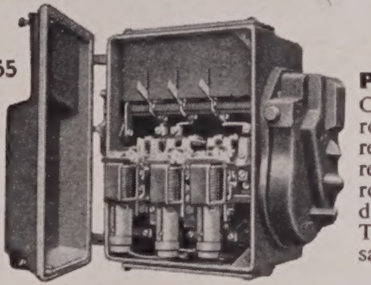

P1264

P1264 Illustrated left, Switchboard recently supplied for controlling diesel Alternator Sets and Feeders at a large Sewage Works. This Switchboard is of the duplicate busbar type and contains circuit breakers ASTA certified at 25 MVA to BS. 116 at 400 volts.


P1044

P. 955



P 955 Illustration on the right is of a hand-operated air break star delta starter, fitted with interlocked isolator and solenoid type overloads with time lags. This starter can also be supplied as a direct-on starter.

P1044 Illustrated right. Combined type stator and rotor starter showing tank removed. No interlocks required as stator and rotor contacts are on same drum in correct sequence. There is also a great saving in floor space.

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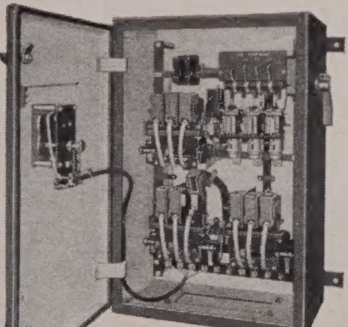
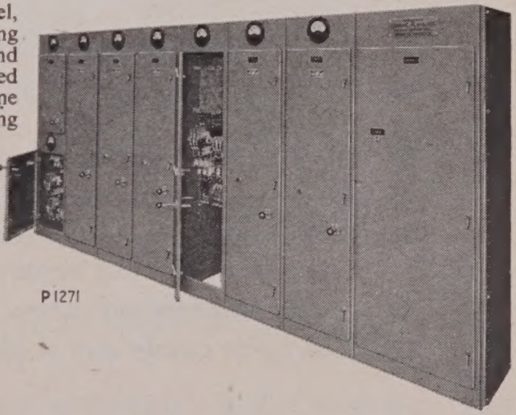
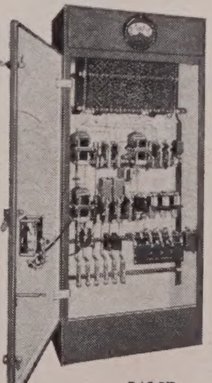

P1266

P1271 Illustrated right. Multi motor panel, contactor type Switchboard, comprising contactor type stator and rotor starters and star delta starters with fully interlocked isolating switches. This switchboard is one of many supplied to one of the leading Petroleum Companies.


P1271


P1267

P1266 Starter illustrated above is one of our CS. 30 pattern star delta starters, suitable for use up to 20 H.P. This type of starter is made in different ranges up to 250 H.P.

P1267 Starter illustrated at the left is a 50 H.P. CS. 75 type stator and rotor starter. This starter is made in different ranges up to 250 H.P. All our contactors above the CS. 15 size are bar mounted with powerful magnetic blowouts.

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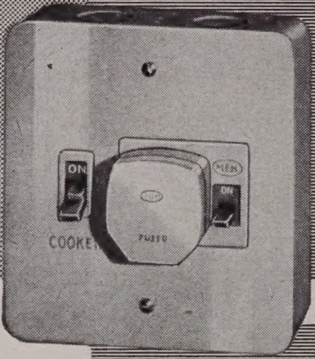
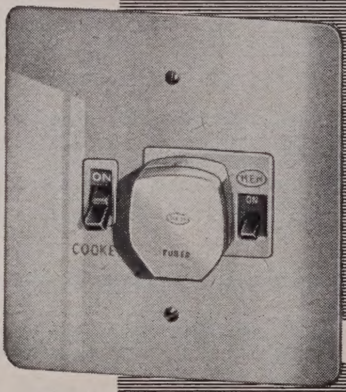
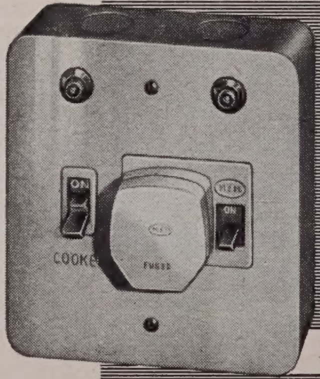


130 CCS



130 CCF



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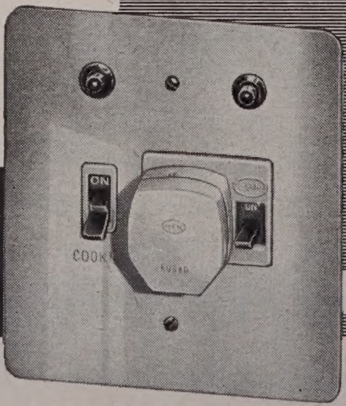

130 CPF

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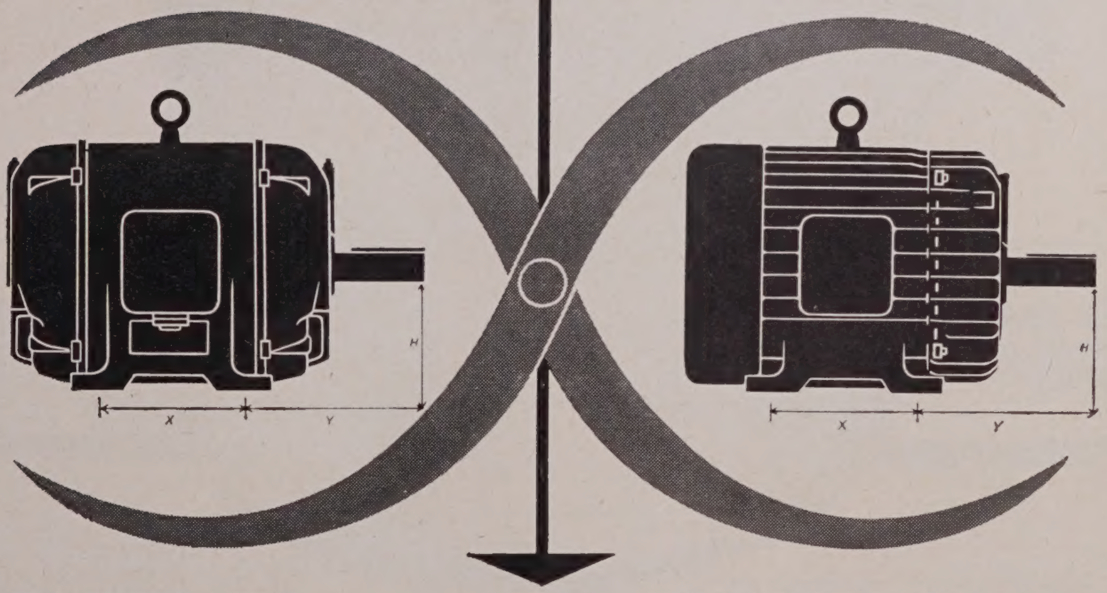

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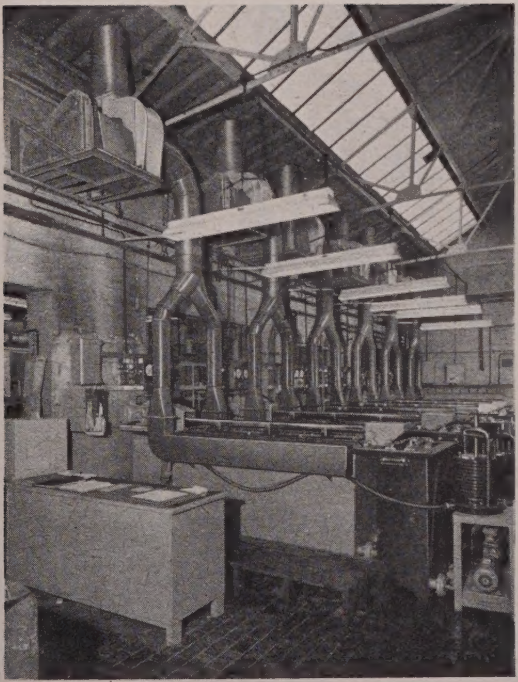

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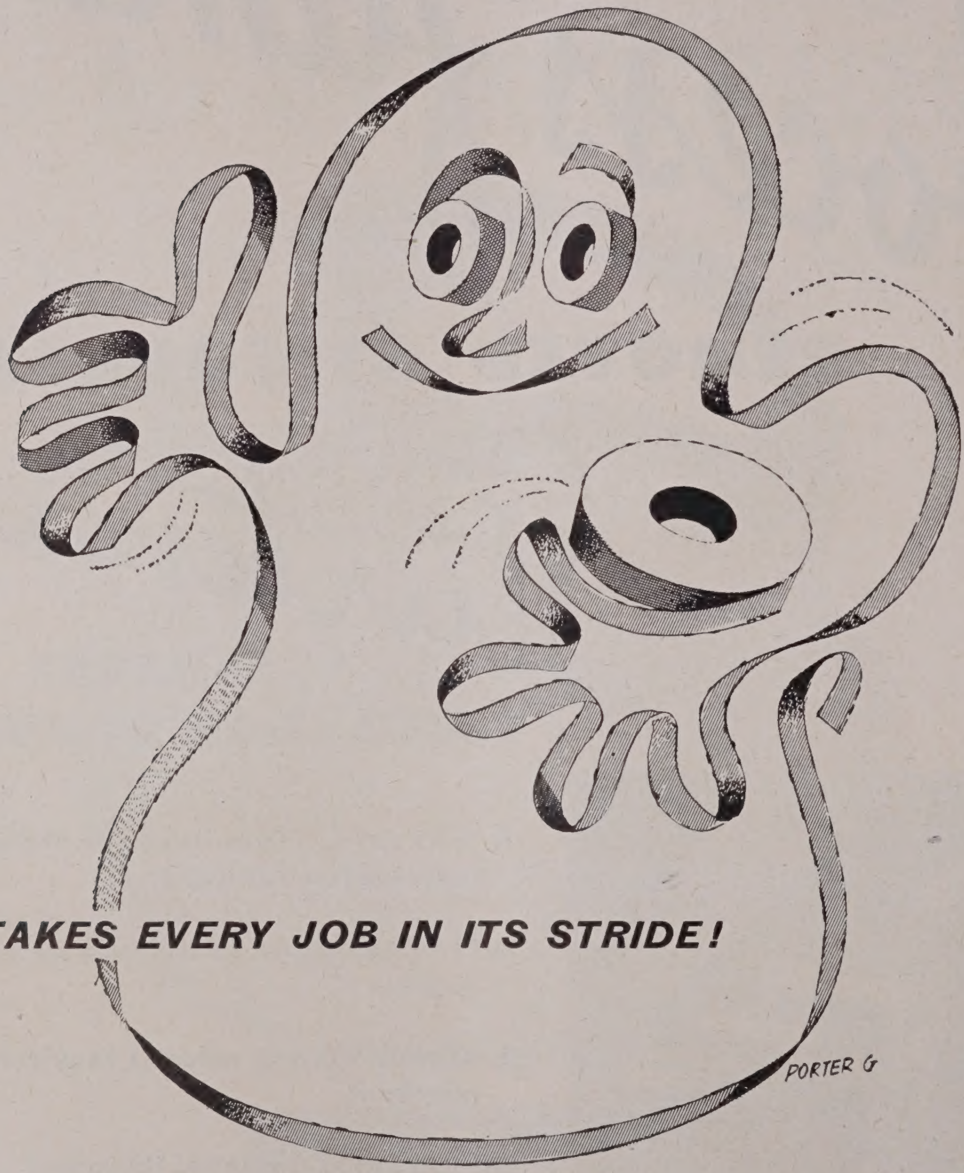

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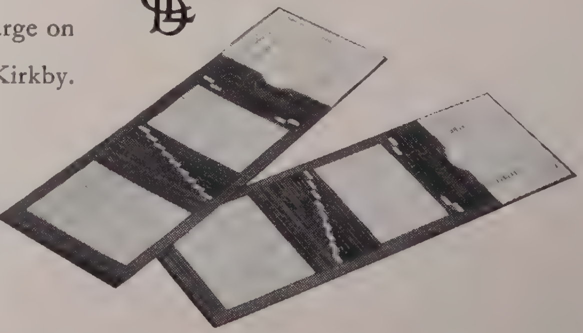

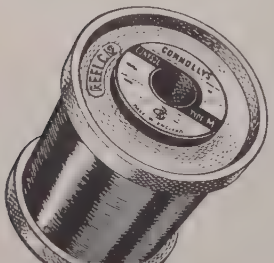

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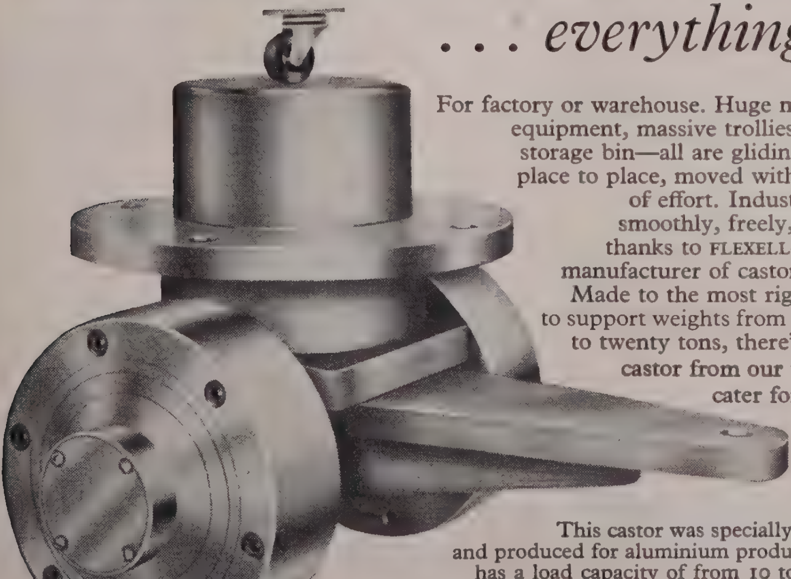

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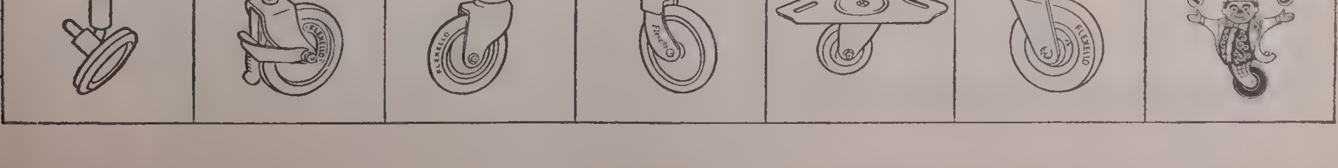

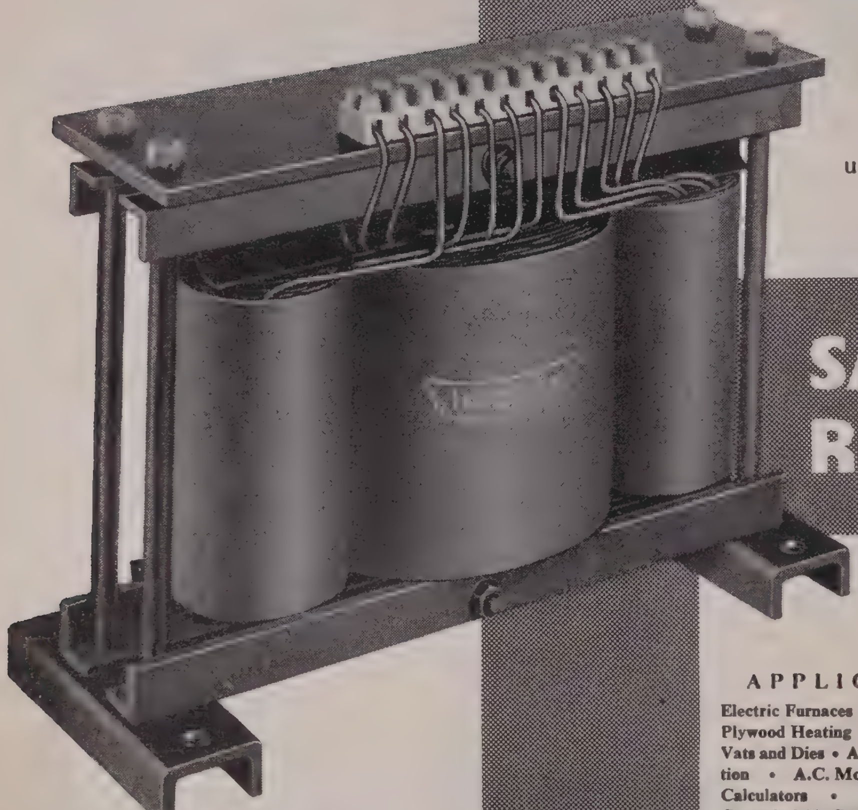

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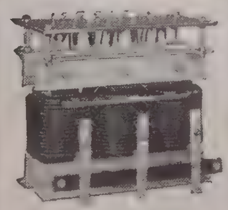

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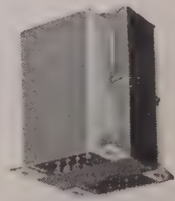

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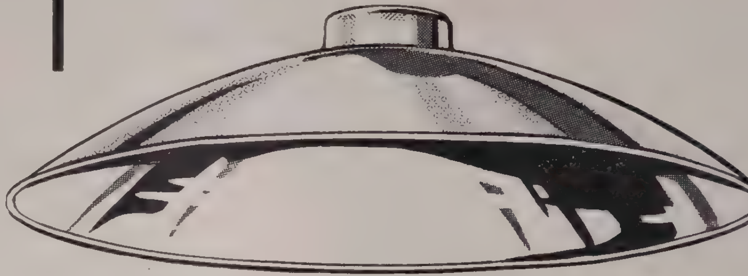

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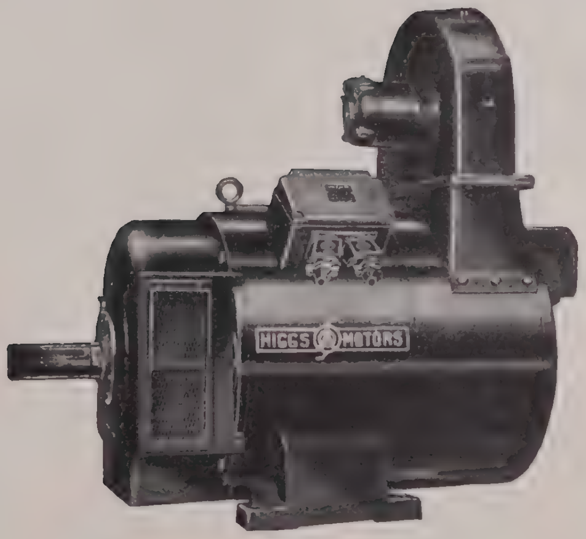

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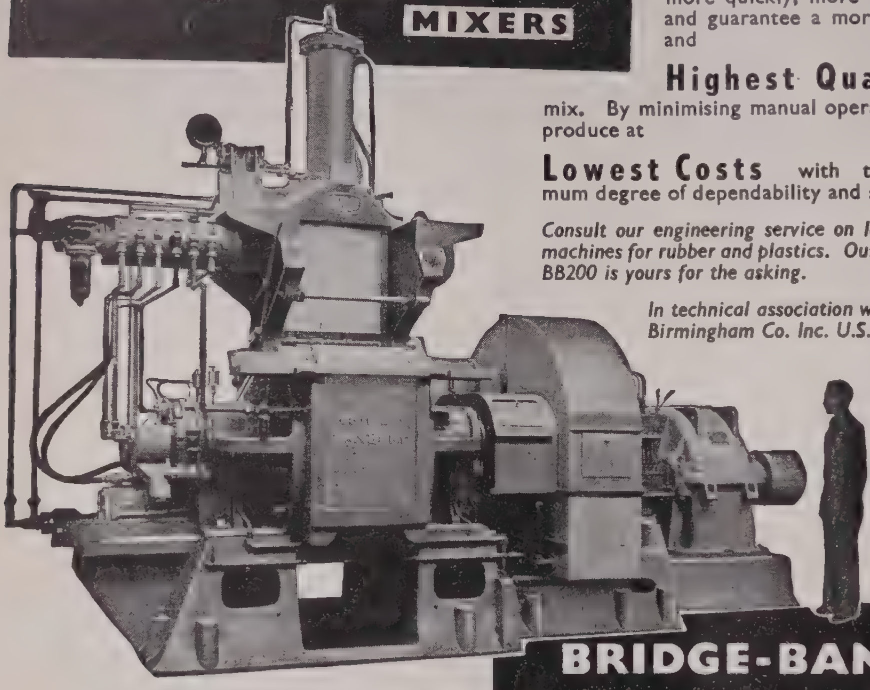

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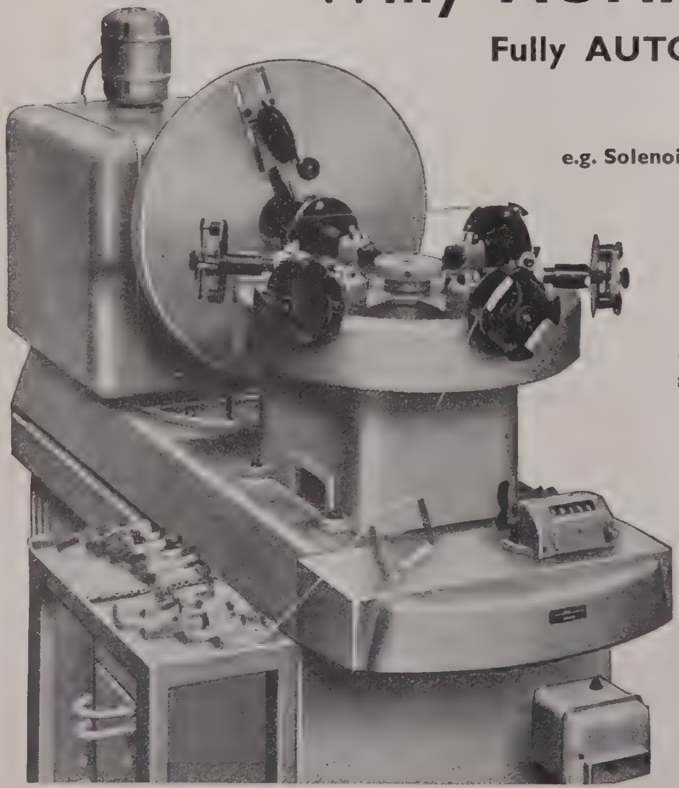

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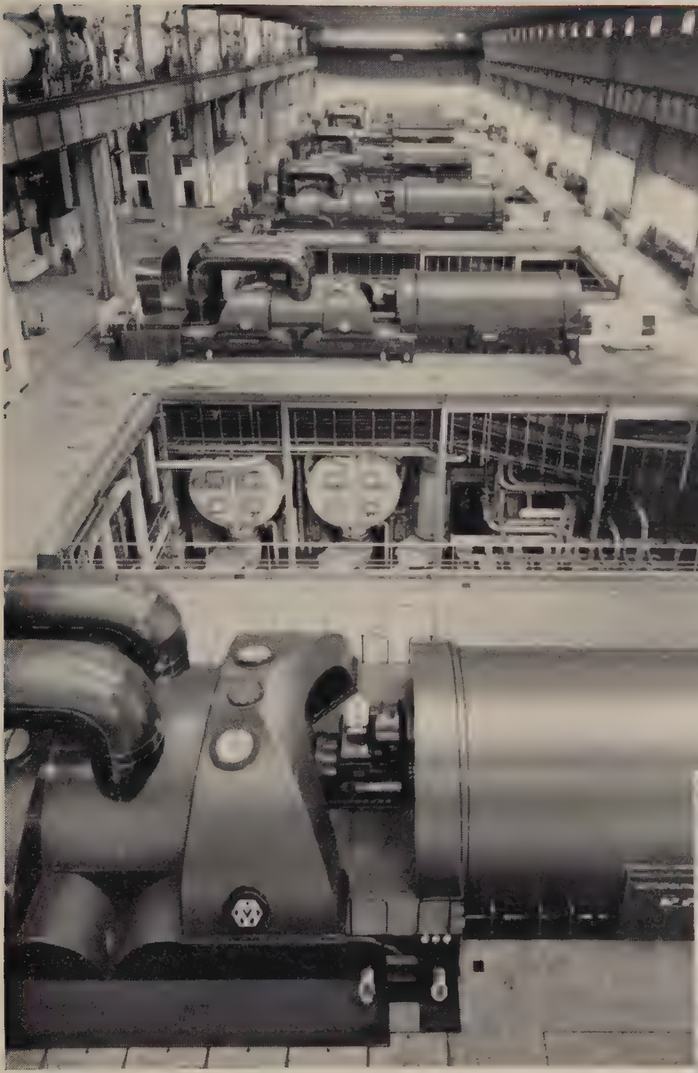

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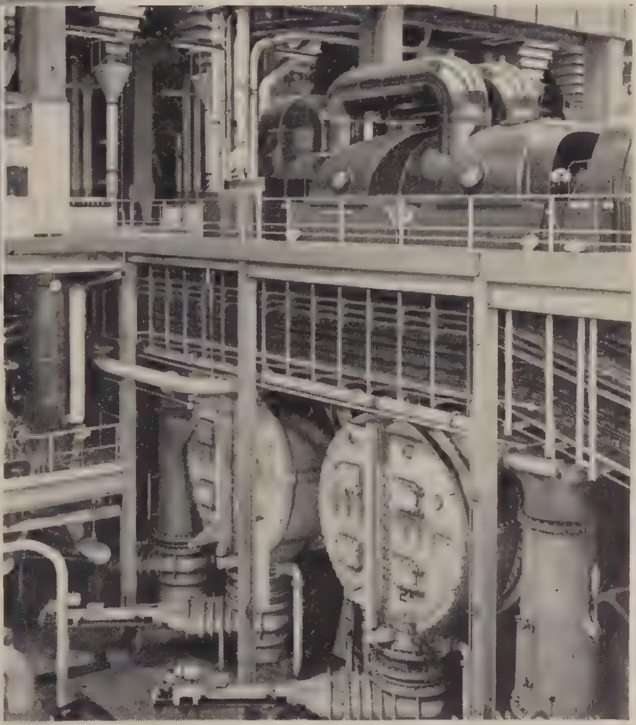

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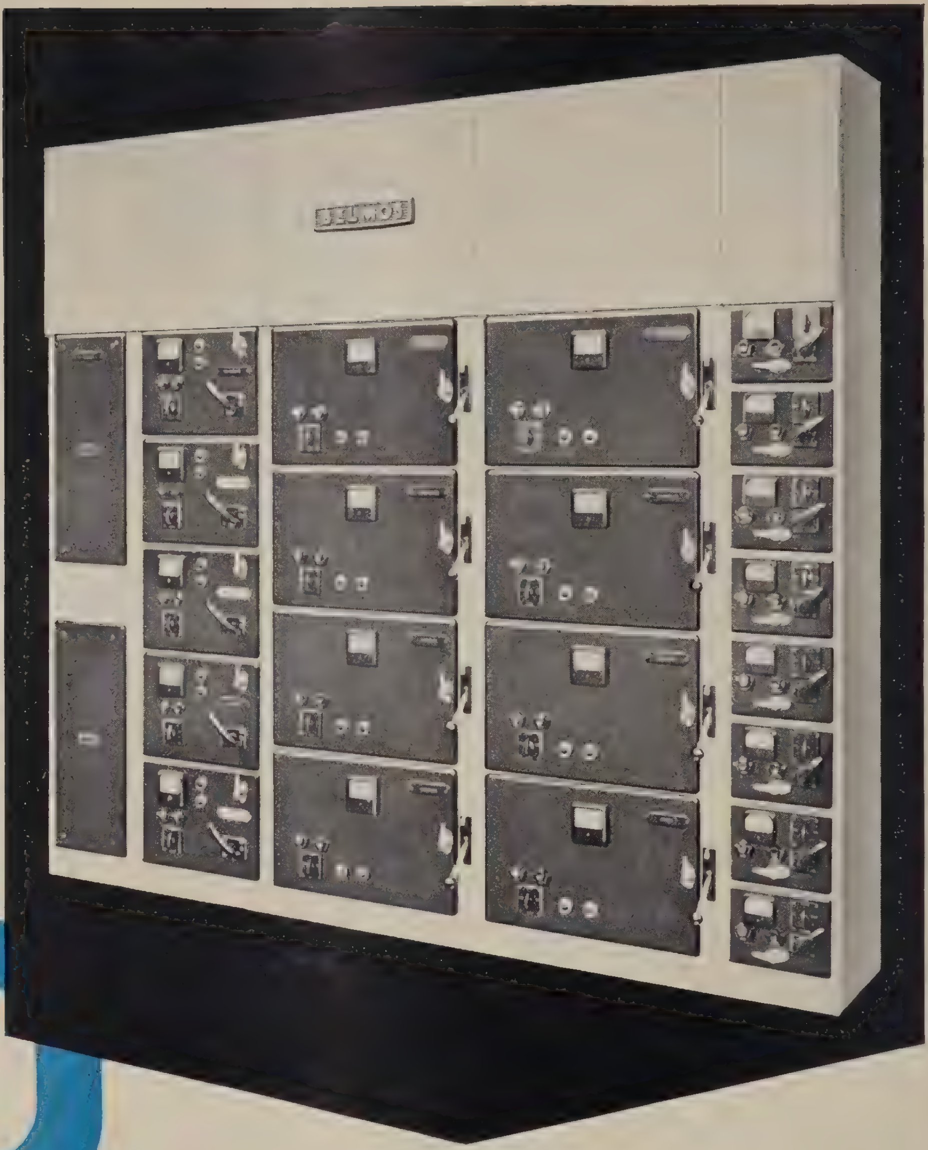

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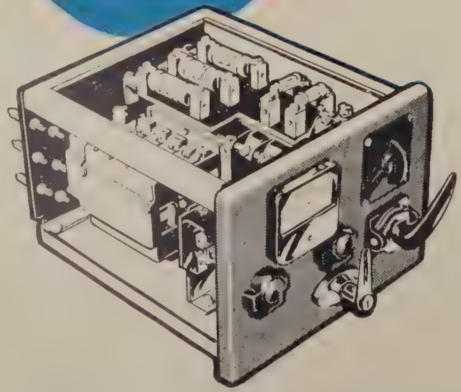
8-tier for small motor starting

The Belmos 'H' range eight-tier cubicle can accommodate eight direct-on-line starters suitable for the control of squirrel-cage motors up to 7½ h.p. at 440 volts. Each starter is fitted with a load-breaking isolating switch and is housed in a plug-in chassis for accessibility and speed of servicing.

★ The 8-tier cubicles can be lined up with the four- and five-tier cubicles of the Belmos G range, which house larger starters for motors up to approximately 80 h.p. at 440 volts.

This unit is fully described in leaflet K 500 which will be sent on request.



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the Belmos company limited

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"but not WOOTTON METER BOARDS Sir"

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Variac WITH Duratrak*

Regd. Trademark

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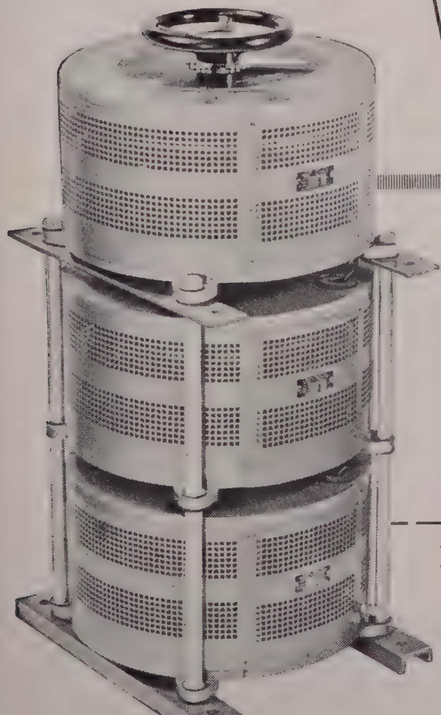

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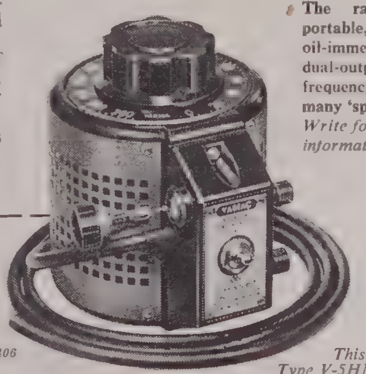
VARIACS are available in a very wide range of models from small units for laboratory and instrument use to large ganged assemblies for three-phase power.
VARIACS are available open or covered, as single units or ganged assemblies, for manual operation or motor-driven.



The range includes portable, metalclad and oil-immersed models, dual-output types, high-frequency types and many 'specials'. *Write for complete information.*

✯ Duratrak? Duratrak (Regd. Trademark) —a patented* feature exclusive to Variac—is a special plated contact surface giving longer life, increased overload and surge capacity and maximum economy in maintenance. Duratrak is now standard on all models except Series 50.

**U.K. Pat. No. 693406*

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This small Variac, Type V-5HMTF, provides an output of 0-270 V, 2 A, from 240 V 50 c/s mains. A still smaller model, Type V-3H is rated at 1 A.

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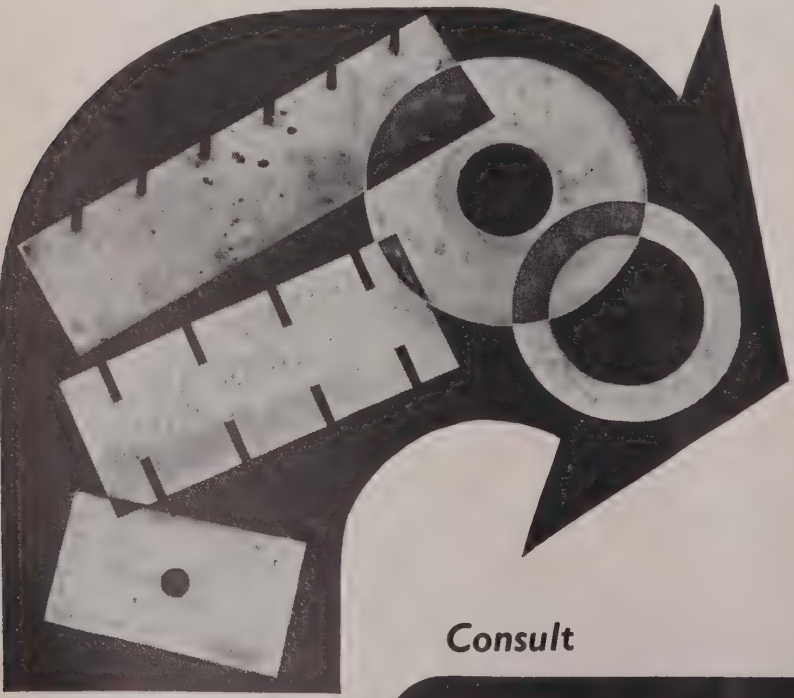

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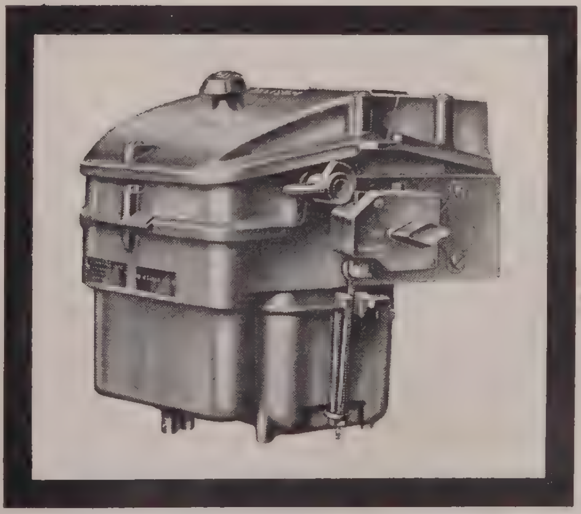

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GEORGE ELLISON
LIMITED

GEORGE ELLISON LIMITED · PERRY BARR · BIRMINGHAM 22B

866

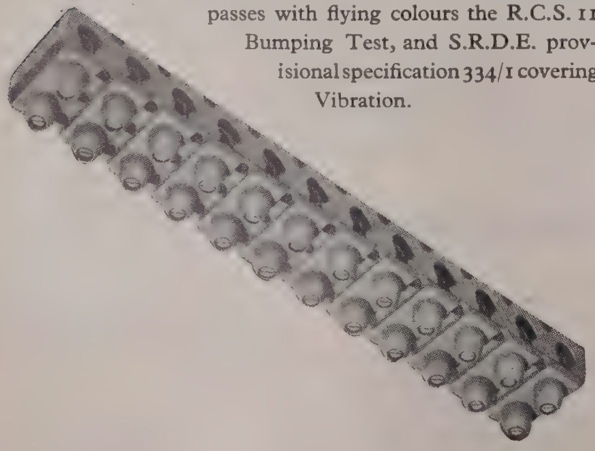
Regd.

do you know?

It *is* a bit of a problem, but don't blame the printer! This is one of the "Belling-Lee" terminal blocks, L.1325, being put through its paces on a power vibration generator. The block is mounted upside down to make conditions more exacting, and the terminal screws are not even tightened—but notice that *they don't fall out.*

This is the patented feature of these terminal blocks, that the screws are gripped by the resilient shielding bosses and stay put under the severest kind of vibration.

The whole block is resilient, which means that it is shatter-proof—sudden shocks or impact will not harm it because it is made of P.V.C. Thus it passes with flying colours the R.C.S. 11 Bumping Test, and S.R.D.E. provisional specification 334/1 covering Vibration.



Yes, it's flexible too of course, so that it doesn't matter if the mounting surface is irregular or even definitely curved. Then look at the screws—we've thought of them as well, and the ends are specially shaped to avoid cutting the finest gauge of conductor. Flash barriers? They're taken care of, and the conductors are fully shrouded right up to the brass terminals, conforming to BS.415, and the insulation resistance is rather good, exceeding 10,000 megohms. Altogether this is the answer to quite a lot of problems, isn't it?

The L.1325 is conservatively rated as 15 amp, but can safely be used at nearly double this current under calculated conditions. Smaller sizes are available with ratings down to 2 amp, and there are right angle types as well for through-panel connections, with spills for soldering, wrapped wire, and taper pin joints.

Please write for fuller details of this versatile family—you really ought to get to know them better, and they exist to help you. Leaflet P423 will tell you more about them—may we send you a copy?

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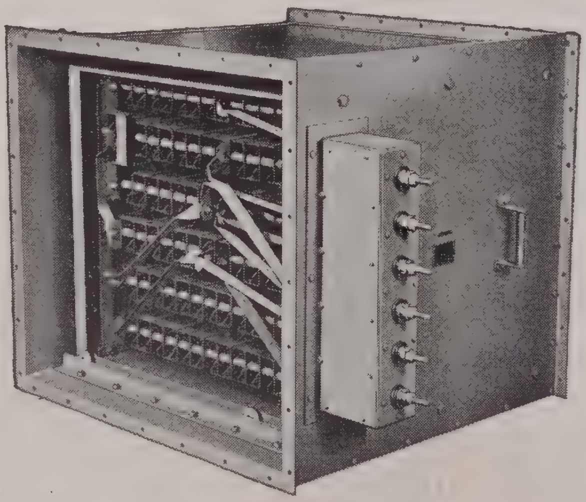
P/6

HEATERS

...from the largest...to the smallest

From a cartridge heater designed to heat an intricate mould to an air heater to warm the largest factory—Expamet-Cressall are in a unique position to supply them all. Highly qualified Expamet-Cressall engineers are always at your service.



* *Expamet air heaters are particularly suitable for medium and large units. They are efficient, light in weight and easily adapted to individual installations.*

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The Electrical Division of The Expanded Metal Co. Ltd.

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Telephone: ABBey 7766
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The Cressall Manufacturing Company Ltd., Eclipse Works,
Tower Street, Birmingham 19. Telephone: Aston Cross 2666

* *Cartridge Heaters made in two standard diameters and several lengths.*

* *Band heaters are clamped around cylindrical surfaces for local heating. Rigid and flexible types are available.*

* *Steel Jacketed Heater units for space heating and public transport and for heating moulds and platens.*

40–50% OF ALL ELECTRICAL FATALITIES

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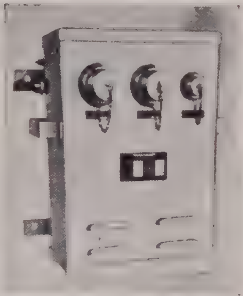
Broken or loose earth wires, or carbon dust accumulation, can produce lethal conditions when the supply is 200/240 v. A.C.

It is for this reason that H.M. Inspectorate of Factories recommends reduction of voltage to pressures not exceeding 110 v. together with the earthing of the mid-point of the secondary winding of the stepdown transformer.

100 VA Switched wall unit

PARTRIDGE LOW VOLTAGE SUPPLY UNITS amply fulfil the industrial demand for reliable, safe voltage reduction. The units comprise a double wound transformer totally enclosed in a steel case of welded construction. An electrostatic screen is fitted between primary and secondary windings. The transformer is vacuum varnish impregnated and additionally processed with a sealing coat of enveloping varnish. Terminations are taken to moulded terminal blocks fitted on panels inside the case. The low voltage output can be terminated with Reyrolle or similar sockets to suit requirements. All secondary windings have the centre point taken to earth and the transformers comply with B.S.S. 794.



2 kVA L.V. Unit to BS794

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1 kVA Waterproof L.V. Unit

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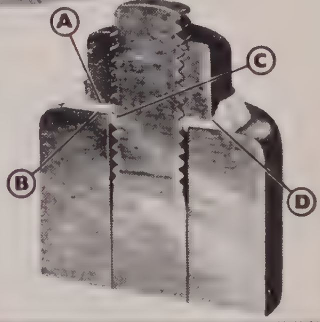
NEW nut-locking principle

'DUBO' RETAINING RINGS

British Patent No. 728,196

with 4-WAY GRIP



When the nut is tightened the DUBO Nylon ring begins a cold flowing action, securely locking and sealing the nut.

(A) Friction on underside of nut.
(B) Friction on bearing surface.
(C) Friction against threads.
(D) Tab action against flats.

- ★ Excellent electrical properties.
- ★ Controls electrolytic corrosion.
- ★ Forms effective insulator.
- ★ Easily fitted, easily removed. Inexpensive.
- ★ Sizes to suit all standard nuts and bolts.
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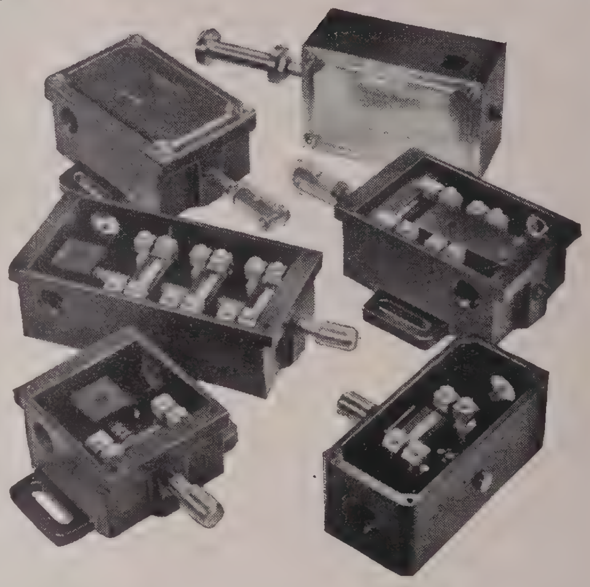

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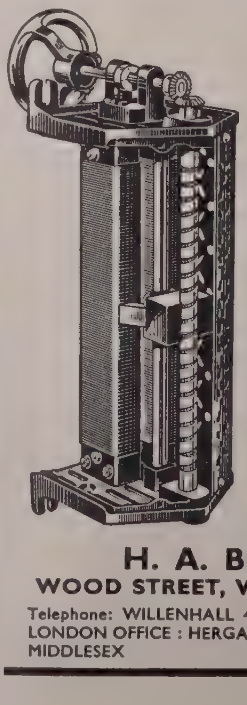
REGISTERED TRADE MARK
for
VARIABLE RESISTORS



Slate wound Resistors of fixed and variable type, incorporating oxidised nickel copper wire to B.S.S. 115.

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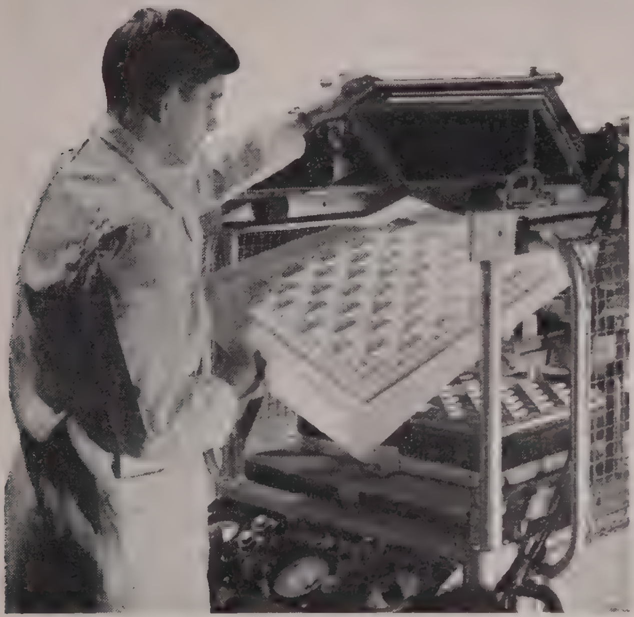
'Flovic' translucent foil for luminous ceilings



Vacuum forming panels in 'Flovic' vinyl copolymer sheet in the T.S. and D. Dept. Laboratories, I.C.I. Plastics Division.

Today many showrooms and similar establishments are lighted effectively by luminous ceilings.

'Flovic' translucent foil has been specially formulated for luminous ceilings. It is tough, free from the risk of discoloration, resistant to burning and optically efficient.

'FLOVIC'

'Flovic' is the registered trade mark for the vinyl copolymer foil manufactured by I.C.I.

This shows a 'Sylvalume' lighting system made by Atlas Lighting Ltd., installed in a Service Centre of the Merseyside and North Wales Electricity Board. This system, which gives a diffused light, incorporates 3′ x 3′ dishes vacuum-formed in 'Flovic' foil. Some of the dishes have a patterned finish and others a plain finish. An octagonal type diffuser is also available in this material.

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PFL2

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M132

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Finsbury Square to Fifth Avenue

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A.C. Electric Motors
from 1/25th to
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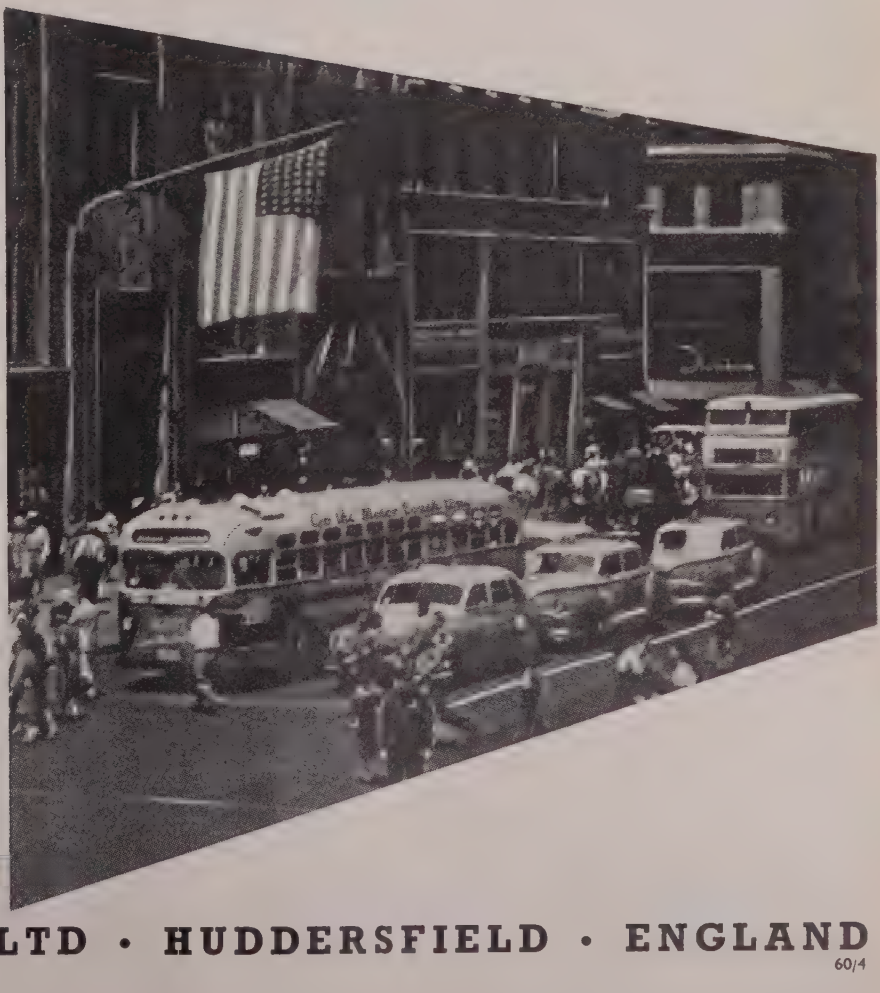

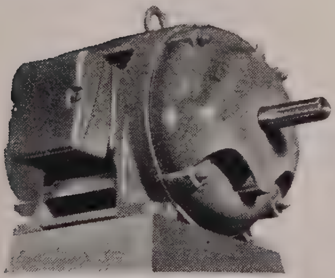

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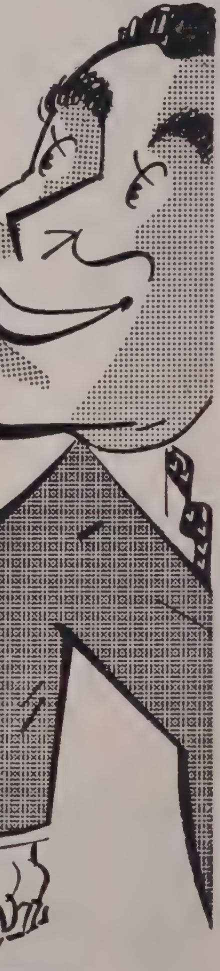

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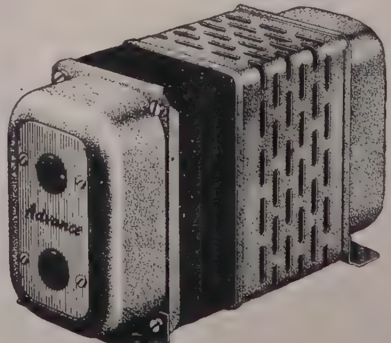
VOLSTAT stands for a range of Constant Voltage Transformers produced by 'Advance'—the leading authority on voltage stabilization.

VOLSTAT is backed by exclusive design, development and manufacturing skills which over many years have so often provided the only solution to mains voltage stabilization problems.

Full technical details are available on request



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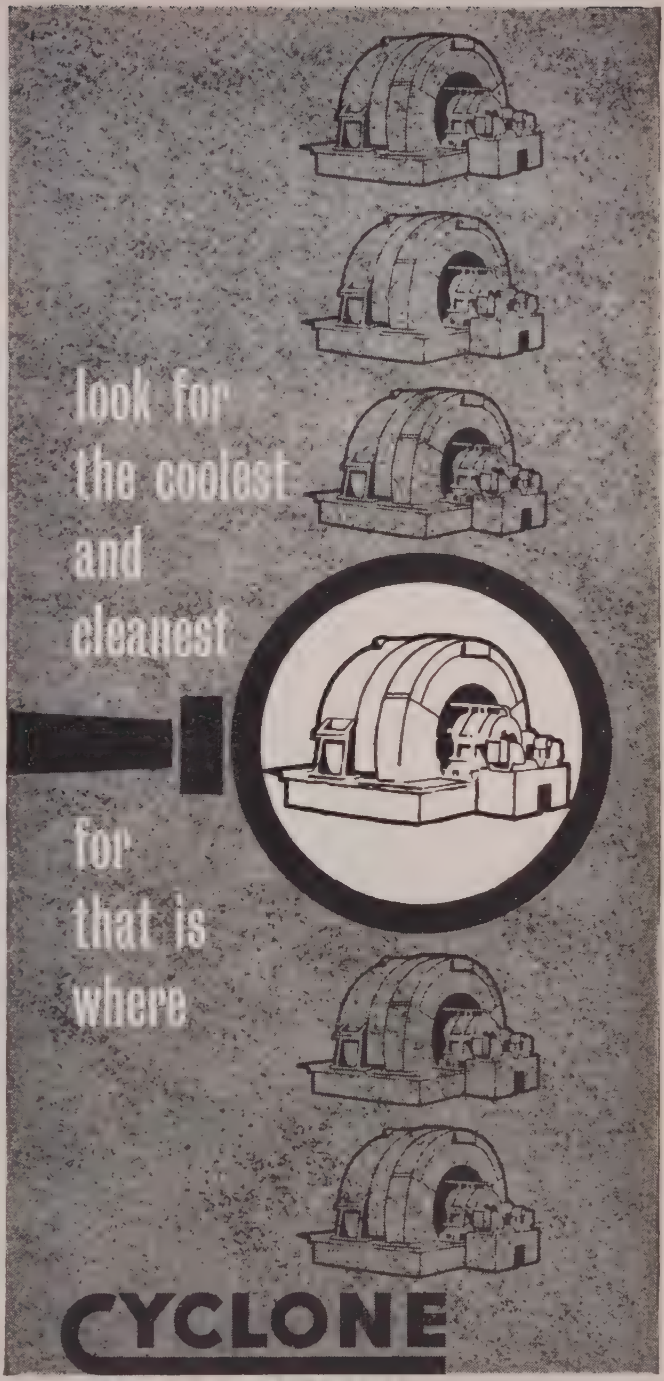

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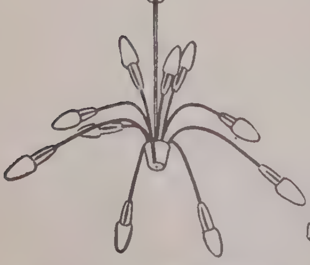
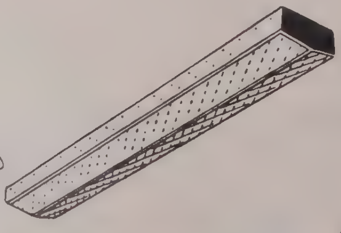
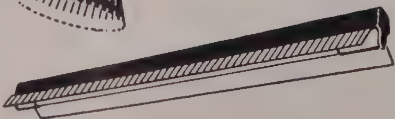
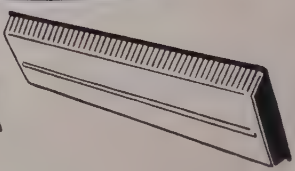
We are at your service from the supplying of a single fitting to the suggesting of a major lighting scheme.









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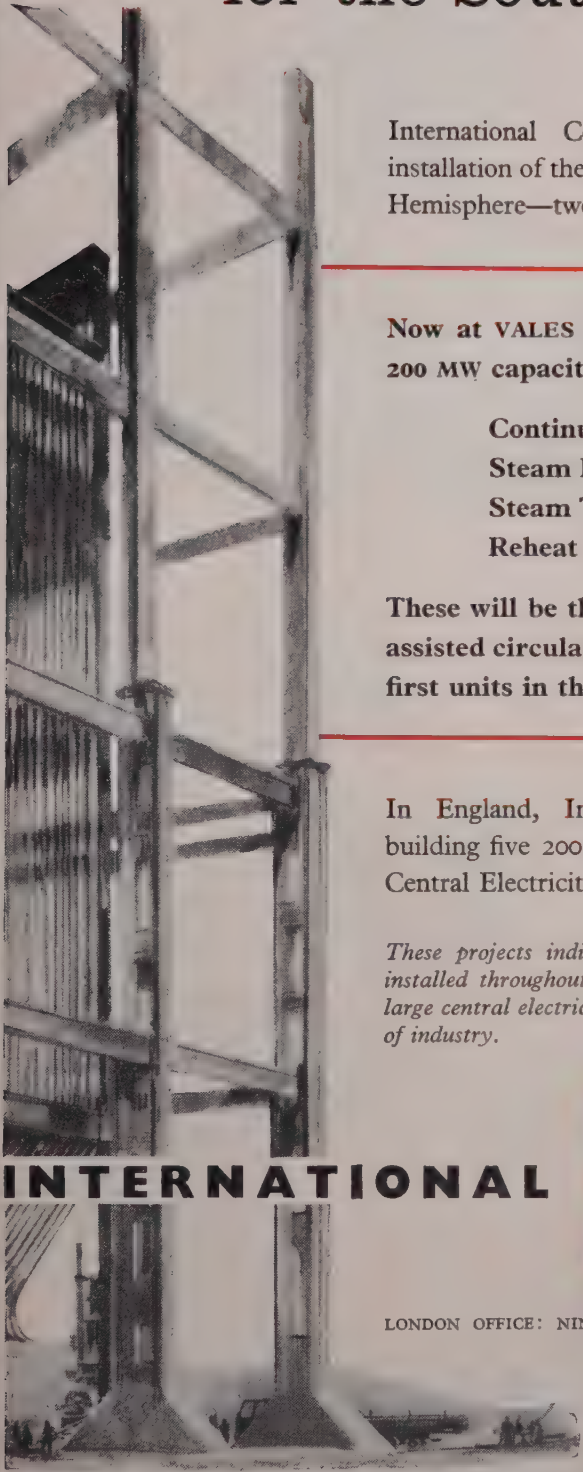
The International Combustion Organisation secures the contract for the LARGEST STEAM GENERATING UNITS for the Southern Hemisphere



International Combustion were responsible for the installation of the first 100 MW boiler units in the Southern Hemisphere—two units at TALLAWARRA, Australia.

◀ 100MW

Now at VALES POINT, Australia, two IC boilers of 200 MW capacity are to be installed:—

Continuous maximum rating: 1,350,000 lb/hr
Steam Pressure: 2,450 lb/sq. in.
Steam Temperature: 1,055°F
Reheat Temperature: 1,005°F

These will be the first high capacity controlled and assisted circulation boiler units in Australia and the first units in the country to employ a reheat cycle.

◀ 200MW

In England, International Combustion Limited are building five 200 MW units and one 550 MW unit for the Central Electricity Generating Board.

◀ 550MW

These projects indicate the confidence placed in IC equipment installed throughout the world, meeting the requirements both of large central electricity generation and the specialised applications of industry.

INTERNATIONAL IC COMBUSTION LIMITED

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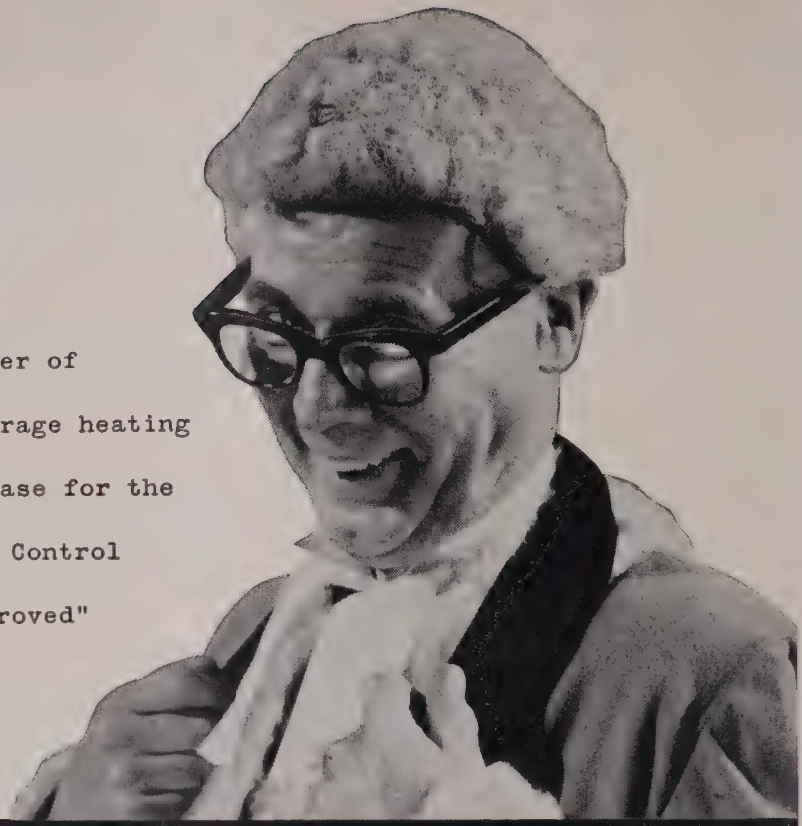
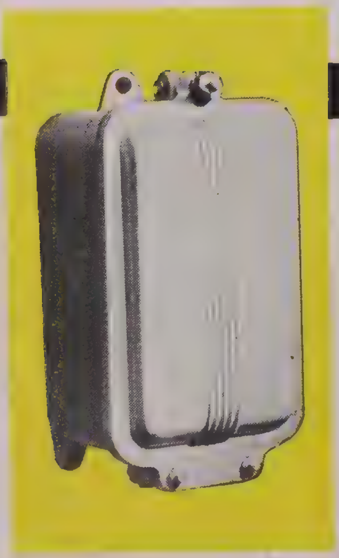
TGA SG84

"In the matter of
Electric thermal storage heating
I submit that the case for the
Satchwell QA/QR Control
is well and truly proved"





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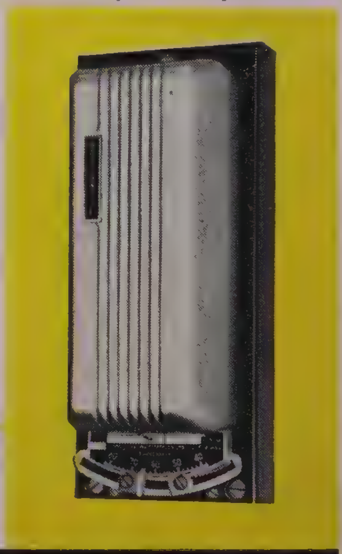

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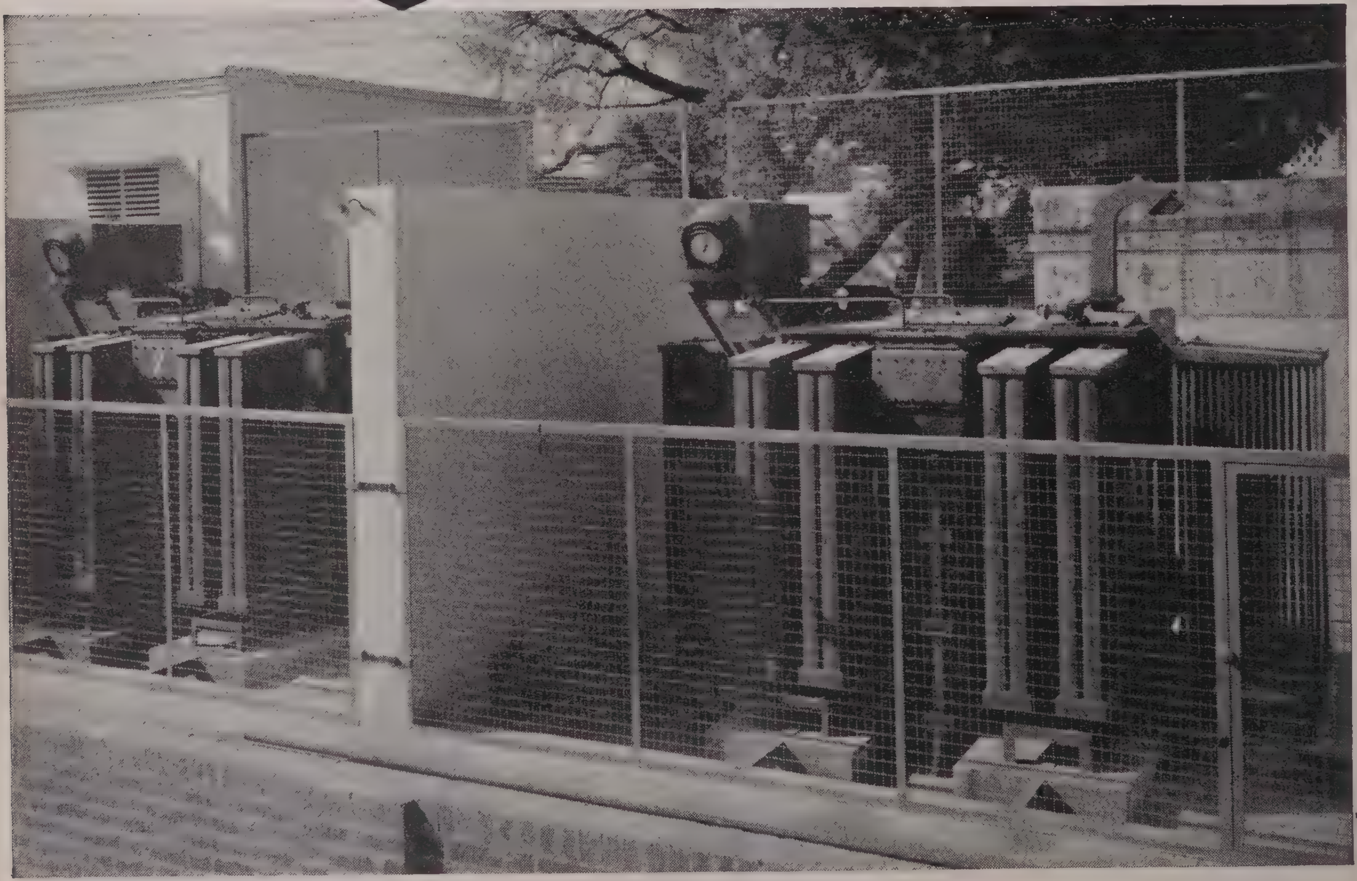

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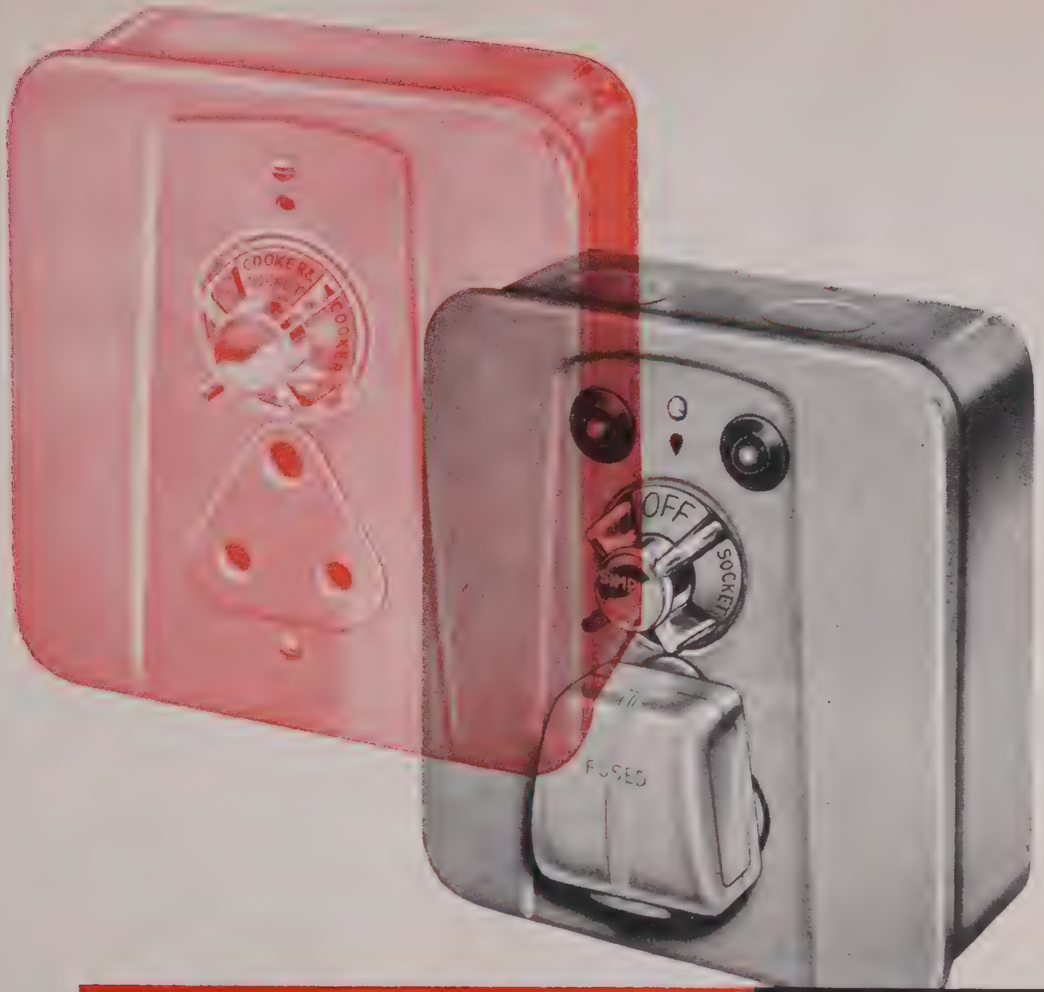

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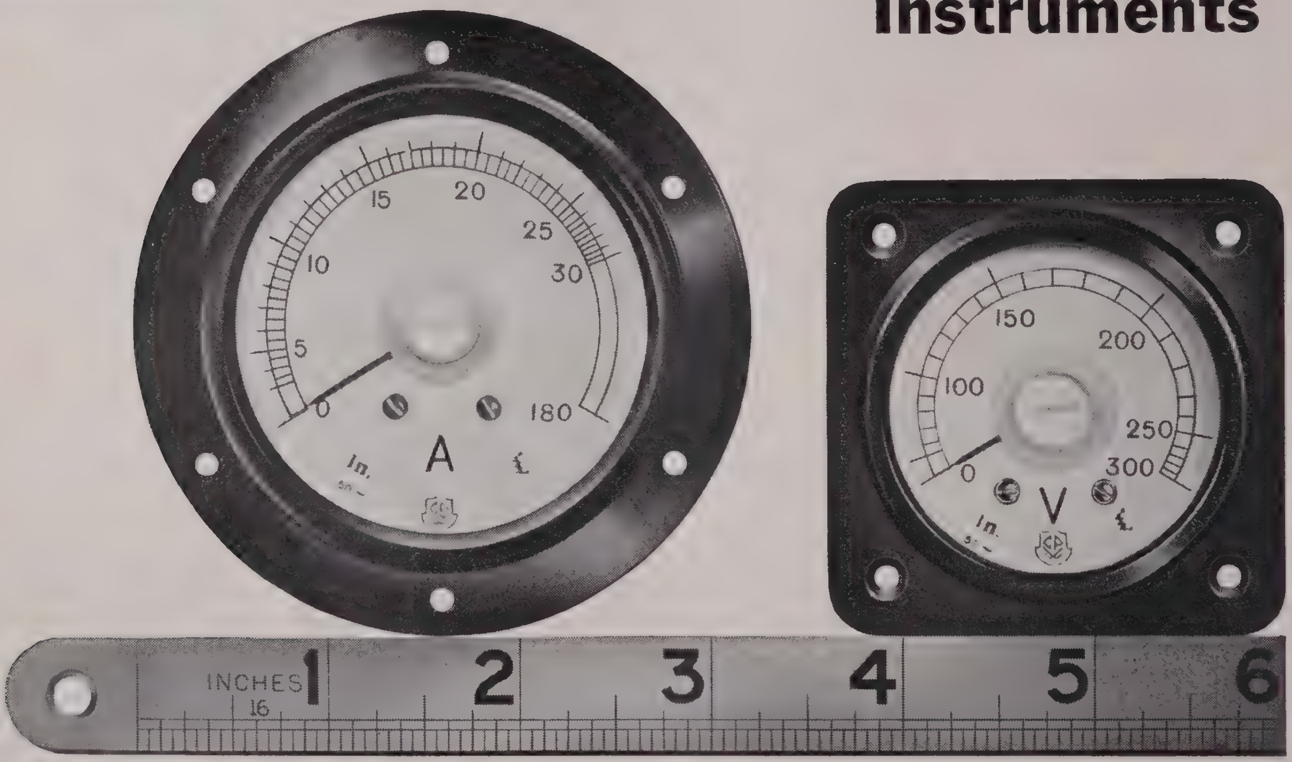

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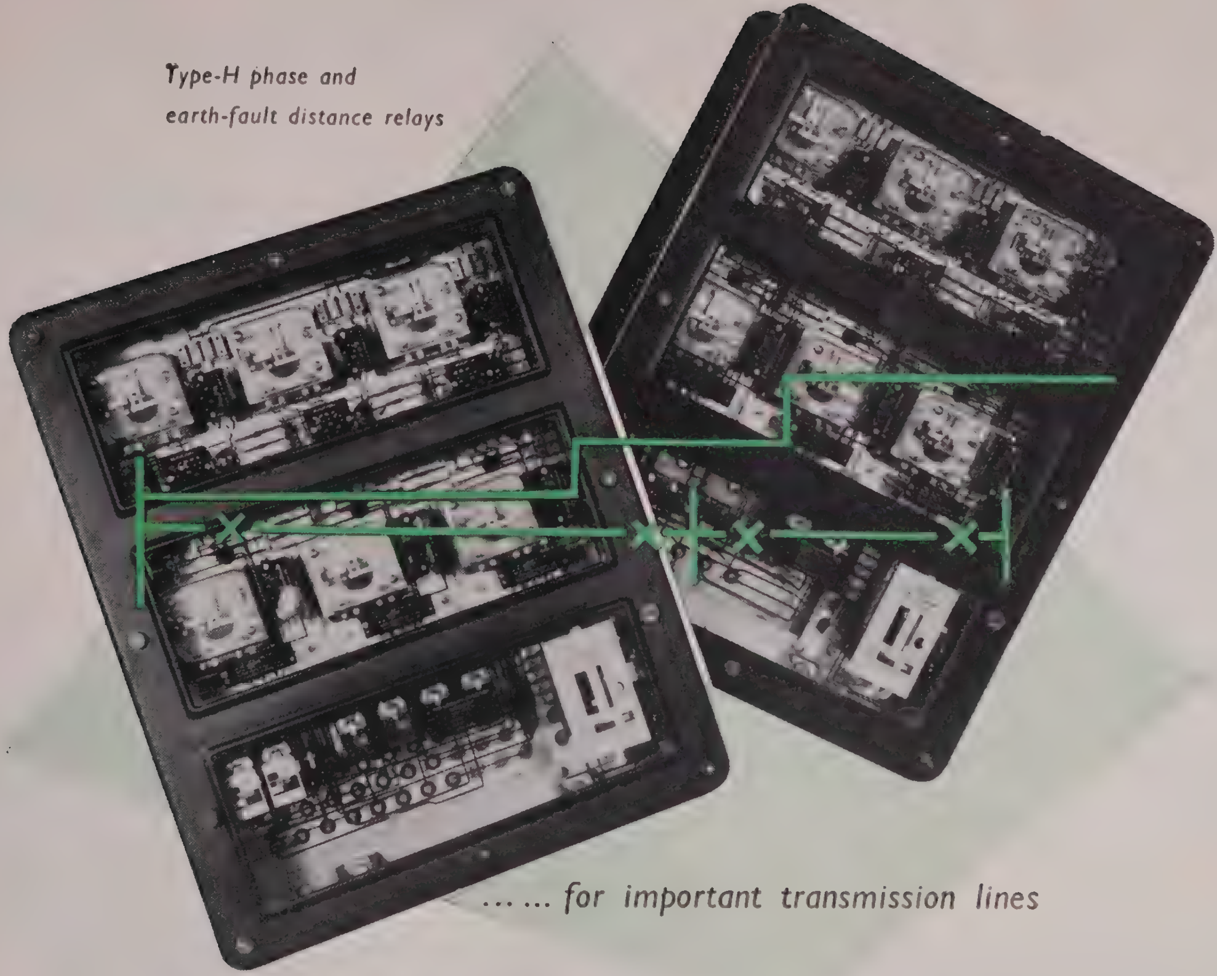

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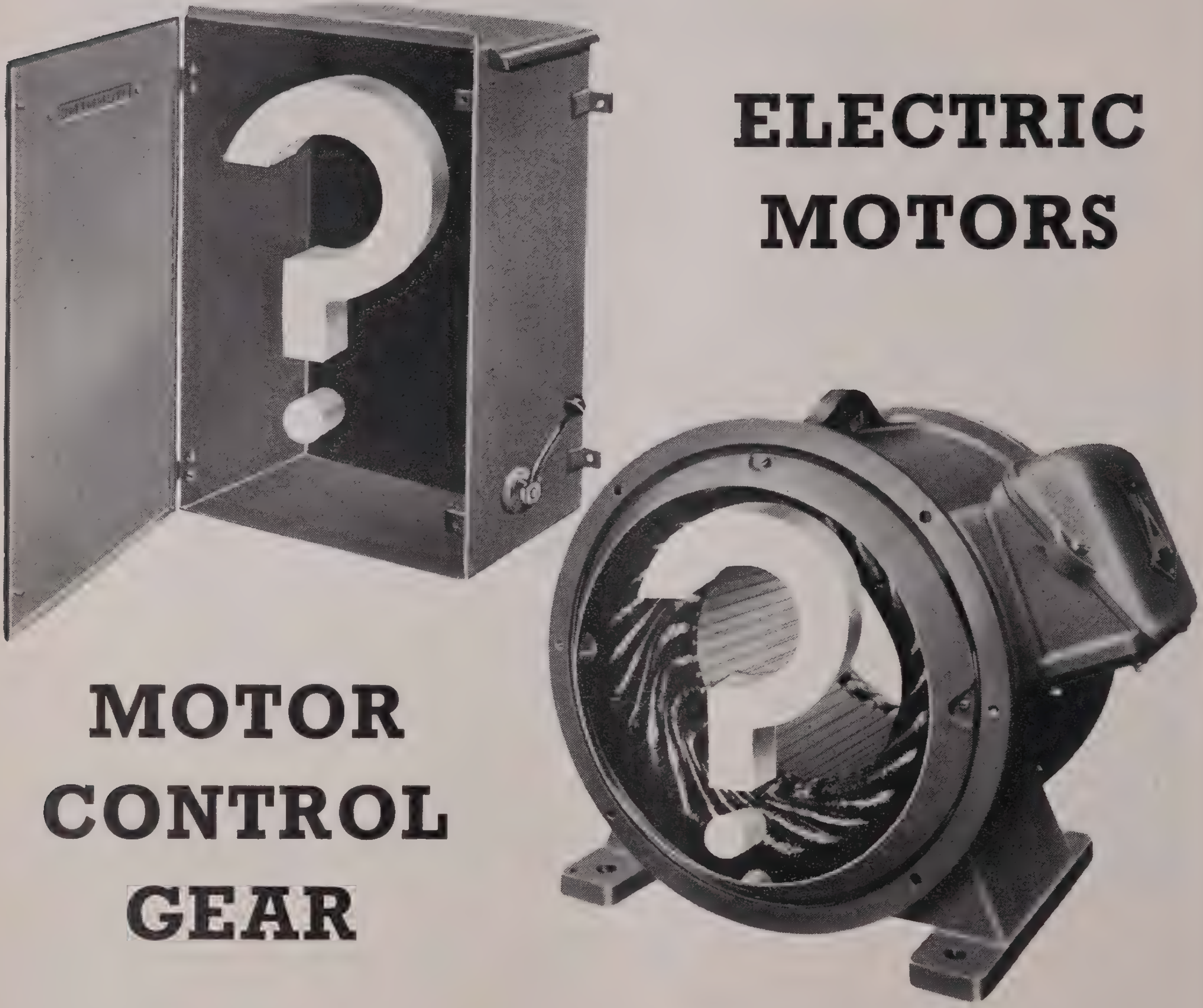

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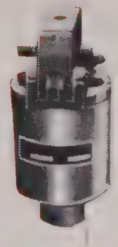

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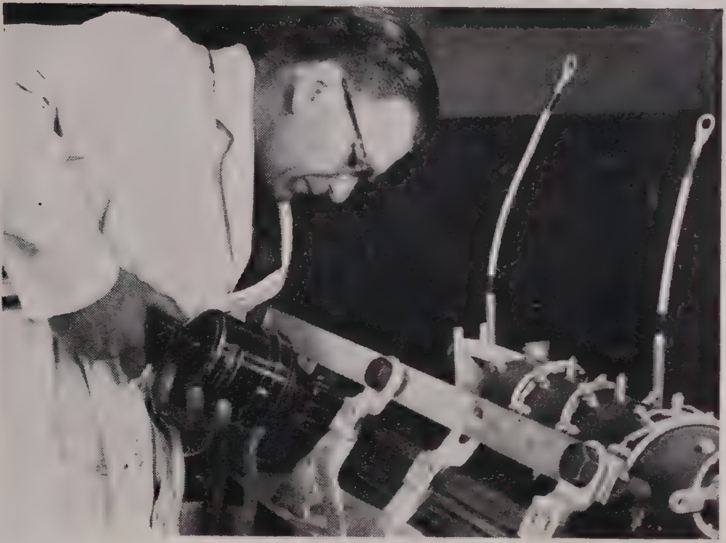

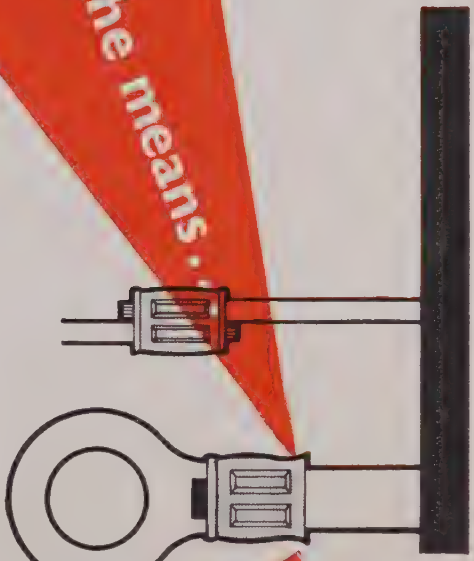

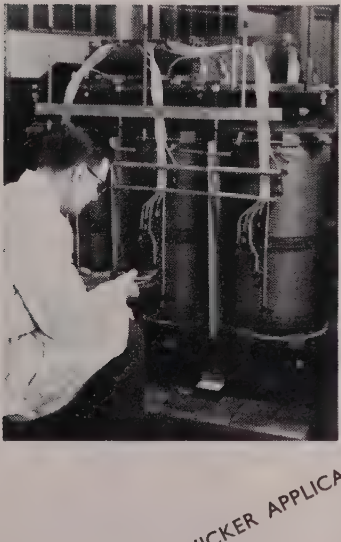

*Dyna-Crimp unit in use for application of M.C.M. range, *Solistrand Terminal to copper risers on Low Voltage side of TI Specification Power Distribution Transformer.*

Pneumatic Hand Tool in use for Parallel Connection of Tap leads to Tap Changing Switch.

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AP 130

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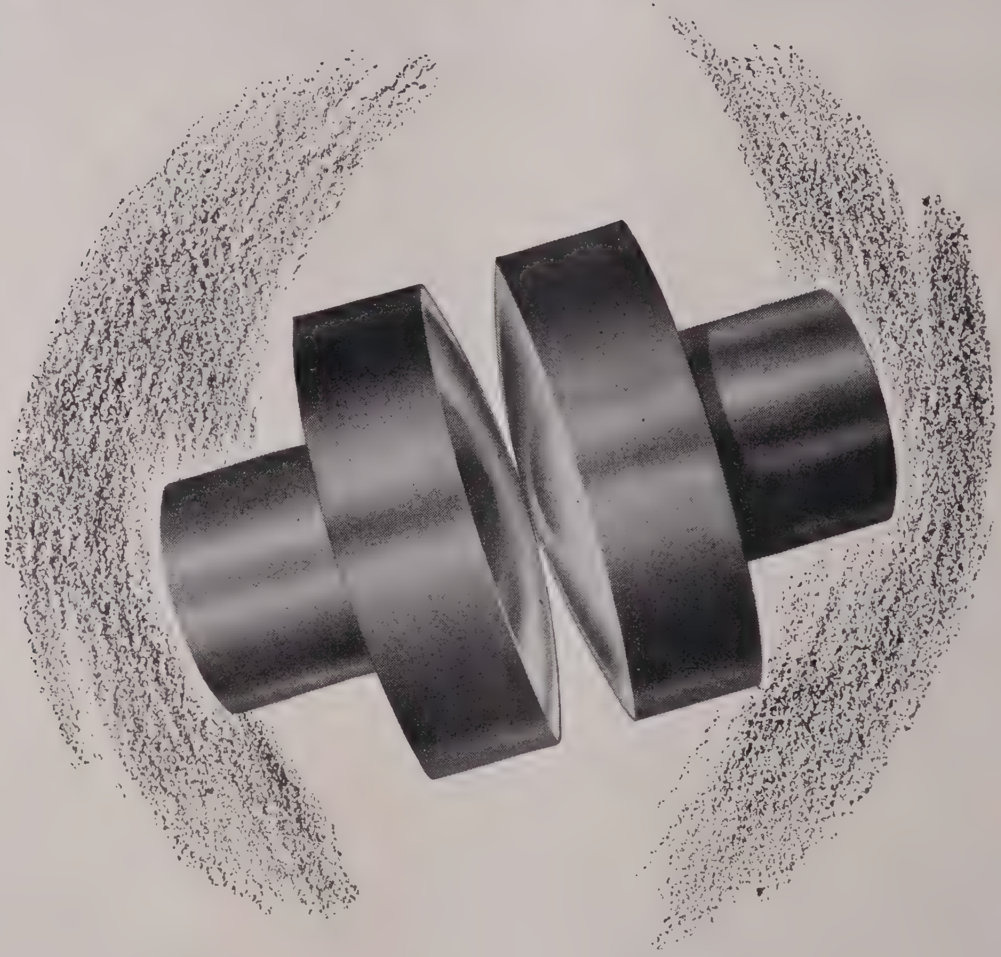

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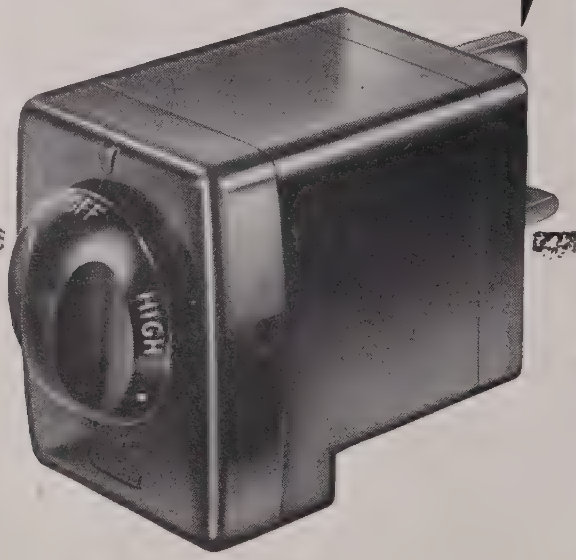

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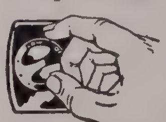

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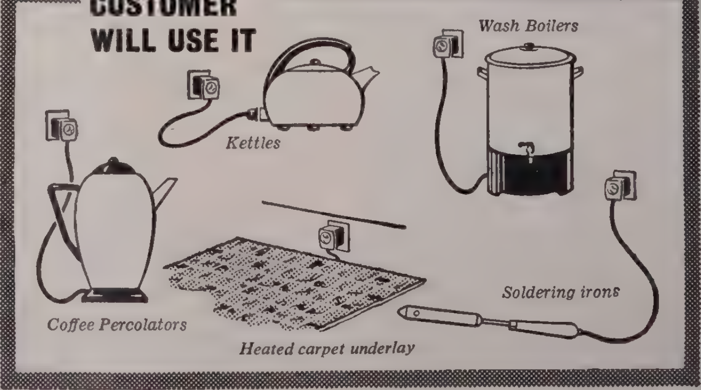

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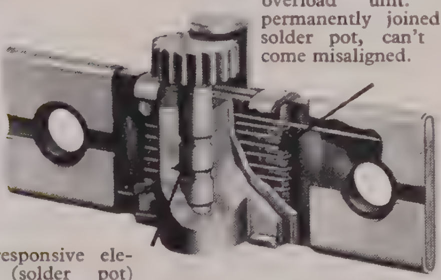

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FRIDAY
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1960

ELECTRICAL REVIEW

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Technical Editor:
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IN THIS ISSUE

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B.E.P.C. at Bournemouth 1049

The twelfth British Electrical Power Convention has taken place this week at Bournemouth under the presidency of Viscount Chandos. In addition to the presidential address (p. 1052) there were four papers (pp. 1054-60), all having as their theme " The New Horizon "

Instruments, Electronics and Automation 1065

Opening the third international Instruments, Electronics and Automation Exhibition at Olympia last week, the Paymaster General, Lord Mills, spoke of the impact which scientific and technical development was making on Britain's industrial life

Modern Instrument Techniques 1066

In reviewing developments in measuring techniques seen at the I.E.A. Exhibition, the author pays special attention to those of general interest to electrical engineers

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Though control systems are becoming increasingly complex, the author points out that the component units are themselves smaller, simpler and probably more reliable

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The heaters covered in this survey range from the 1½-3 gal sink models to 20-30 gal types for supplying the complete hot water needs of a household. Details are given of capacity, loading, finish and price

◆ ◆ ◆ ◆

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VOLUME 166 NUMBER 23 ◇ *Eighty-Eighth Year of Publication* ◇ FRIDAY PRICE 1s 6d

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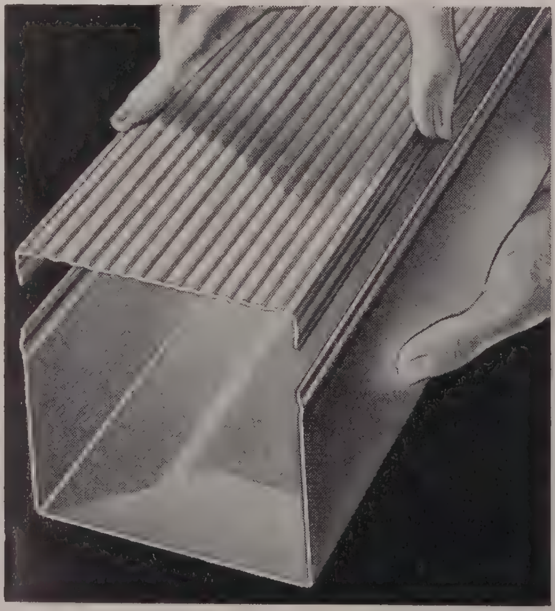

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ELECTRICAL REVIEW

3 June 1960 Vol. 166 No. 23 Established 1872

Recognising the Need for Change

IN his recent speech to the National Production Advisory Council, the Chancellor of the Exchequer turned from his previous theme of the need to reduce prices, to ask everyone concerned " in wage negotiation, in profit and dividend policy, in investment planning . . . to accept a new responsibility to make their actions consistent with our need for higher exports." Industry requires from the Government, however, not vague exhortations but clear and practical policies that will assist those firms who are already engaged in exporting and induce others to direct more of their efforts to this end. Constant shouting at industry has little effect and tends to put a wrong emphasis on export. Overseas business should be undertaken for its own rewards and the overall benefits that a firm will receive from spreading its markets. Exports cannot be treated as a " poor relation " but must be the subject of an agreed and stable policy both nationally and within an individual company.

Once this approach is accepted, the need for fresh thought on many current problems becomes pressing. This was made clear in the presidential address which Lord Chandos delivered at this week's British Electrical Power Convention and in the papers presented by Mr. H. G. Nelson and by Mr. E. V. Small.

Much is heard of the need for a large and steadily developing home market as an essential basis for an expansion of exports. Less attention is given to the benefits which buyers in the home market may receive from manufacturers' export activities. Again, the requirements of overseas buyers and growing competition from local manufacture and other industrial nations exert a strong influence on the structure of the electrical manufacturing industry in this country and its methods of commercial operation. Mr. Small argued that our sales effort abroad would have a greater impact if there were less duplication of effort. Compared with other countries we have more large firms in each industry and in present conditions this is a source of weakness. One solution which Mr. Small advocated strongly is the extension of the practice of group contracting linked on the financial side with a more positive approach by the banks to overseas investment. Such an approach has been employed with much success on the Continent.

Lord Chandos referred more directly to the cost and effort involved in submitting four tenders for one nuclear power station, and pointed to similar frustration and waste in other research and development activities. Some duplication and untidiness are inevitable in a competitive economy, but Lord Chandos urged the need for greater mutual confidence among leading manufacturers so that, without undermining competition, research could be combined over a wide field. Mr. Nelson believed that if there was to be security of employment and continuity of savings then free competition in the classical sense was no longer realistic.

Normal economic pressures and technical advances will almost certainly lead to a greater measure of rationalisation in the electrical manufacturing industry and it is an assurance of continuing strength and vitality that the need for change is being recognised, at least in the largest organisations. But these firms do not comprise the whole electrical industry; the problem of the future role of the many medium-sized and small firms, and particularly their contribution to exports, demands no less serious consideration.

FUTURE POWER PRODUCTION

Mr. C. R. King's Convention paper may be regarded as a " report to the nation " on the present position and aims of the electricity supply industry. He showed very clearly how the power stations under construction and projected (including five nuclear plants) would be commissioned up to 1964. In that year nuclear power will represent about 10 per cent of the total output—a significant figure reflecting the need for high-load-factor operation. An interesting new development which Mr. King mentioned is the Ffestiniog pumped-storage scheme. In this connection—energy storage—he spoke of future possibilities in the fuel cell and compressed air, and he also made brief reference to direct methods of electricity generation.

Mr. King had no doubt of the future in which increasing demand for electricity would be paralleled by new and improved methods of producing it.

DOMESTIC PROSPECTS

Some practical views on the ways in which to stimulate the sale of electrical appliances and electricity to the domestic consumer were embodied in Mr. T. E. Daniel's paper at the British Electrical Power Convention. One important thing is to convince the public that the newer boiling plates on electric cookers are just as " fast " as gas rings. Electric water heating is, of course, more satisfactory than doing it by gas but people need to be educated in its economical use.

Looking towards the future, Mr. Daniel might be accused of excessive optimism when he visualised a three-bedroomed house of the late 1960's with a total connected load of 95 kW. While the annual bill (for a consumption of about 38,000 kWh) was put by Mr. Daniel at £113, he said nothing about the cost of the equipment, which would be pretty high. We suppose that it might be claimed that practically all of the appliances are essential to modern living and that if they were not electrical they would have to be something else—and less satisfactory.

CROSS-CHANNEL POWER LINK

Work has now begun on the cross-Channel power link which will connect the national electricity supply systems of Britain and France. It is the construction of the Lydd convertor station which has been started, and next year the actual laying of the cables will be undertaken. It is estimated that the cost of manufacturing and installing the d.c. cables and associated equipment will be about £4·6 million. Against this outlay, there will be in Great Britain a saving of about £8 million in peak load plant which would otherwise be necessary.

There is a great diversity in the times of peak demand for power in Britain and France but equally important is the seasonal help which each country can give the other. France obtains about half of its energy requirements from cheap power generated in hydro-electric stations in the Alps, the Massif Central and the Pyrenees. Surplus energy from these stations can, therefore, be fed into Britain at peak times, thereby reducing the amount of old and expensive coal-fired generating plant which would otherwise have to be used. Economic exchanges will also be possible between the two countries at off-peak times, Britain importing all the excess hydro-electric energy available in France and reducing its thermal generation by an equivalent amount, while France could import energy from Britain's efficient plant and conserve the French water resources. From the French point of view it has been calculated that the net annual saving attributable to this interconnection will be £250,000.

INTEGRATION

The Instruments, Electronics and Automation Exhibition is one of few of the ever-increasing number of displays which we are able to describe in some detail. The others which we regularly discuss at length are the Electrical Engineers' and the Mechanical Handling Exhibitions. All three are complementary and the equipment shown covers the complete range of modern industrial requirements. The second industrial revolution, which is, of course, based on the availability of electric power and electrical control systems, is essential for the maintenance and improvement of the standard of living, and Britain's export trade is dependent on our lead in this field. These are the reasons why we endeavour to describe the features of these three exhibitions and thereby regularly take the opportunity of recalling recent developments.

The term " revolution " is perhaps unfortunate since modern industrial techniques are based on the integration of components, not substitution. This fact is emphasised by the I.E.A. Exhibition, in particular. In all industrial processes, instruments are used to provide the measurements required by the control system and, in individual integrated automatic processes, the control system is usually based on electronics. In a general process control scheme, a " memory " and a capacity for taking decisions are also required.

The platform at the opening session on Monday afternoon: Lord Chandos delivering his presidential address.

PROCEEDINGS AT BOURNEMOUTH

APPRECIATION OF THE PRESIDENTIAL ADDRESS

THE success of conferences, especially at seaside towns, depends largely on the weather and that must be our excuse for falling back on this gambit. The British Electrical Power Convention is invariably fortunate in this respect and conditions at this year's gathering at Bournemouth followed tradition.

Customarily the affair is inaugurated by the opening of the exhibition but this time, with no exhibition, the first event was the civic welcome followed by the presidential address. Lord Chandos greeted the delegates at the Pavilion on Monday afternoon and introduced the Mayor (Councillor Mrs. B. Bicknell, J.P.).

Her Worship, in extending the town's welcome, said that she had been Mayor for something less than three hours and as this was her first public duty it would remain memorable to her.

After reading a telegram from the Convention to Her Majesty the Queen, Lord Chandos delivered his address, a summary of which appears in later pages. Although the President dealt with a number of very serious topics he treated them in a most palatable way and with touches of sly humour which were greatly appreciated. As will be seen from our summary, he was concerned with the problem of manufacturers in disposing of the products of an extended capacity with a limited home market. He particularly exposed the unwisdom of accepting contracts from some countries whose ability or willingness to pay was questionable. He urged greater co-operation between manufacturers in the matter of fundamental research and in the pursuit of export business.

While he seemed to be doubtful about some aspects of the electrical industry's present situation his address upon the whole was by no means gloomy. Indeed he concluded with an expression of faith in the future of the industry as a career for young men and as a principal contributor to mankind's progress.

Mr. W. K. G. Allen, Chairman of the British Electrical and Allied Manufacturers' Association, in proposing a vote of thanks to Lord Chandos, said that the address was "enthralling." From it he (the speaker) had learned much about the man and about matters of great import. Despite the disadvantages of a classical education to which he had confessed, Lord Chandos had really not done too badly. He had shown his belief in the inevitable advance in the standard of living and the need for more electric power. Mr. Allen said that he agreed that the great improvement in the efficiency of power plant had imposed great problems on manufacturers. In this direction he spoke with appreciation of the good relationships existing between the electricity supply authorities and the electrical manufacturers.

The manufacturing industry must do all in its power to meet foreign competition and he agreed that much could be done in this way by co-operative effort. It was important both to the employers and their workers that improvements in wages and conditions were matched by improved production if the industry was to be competitive.

Mr. Allen concluded by saying that Lord Chandos' address was full of originality, inspiration and hope and his message should be passed on to their own organisations.

On Monday evening the Mayor held a reception at the Pavilion and this was followed by a dance.

Electrical Manufacture

At the Tuesday morning session Mr. H. G. Nelson, managing director of the English Electric Co. Ltd., presented his paper, "The New Horizon—Electrical Manufacture." The discussion, led by Mr. F. H. S. Brown, deputy-chairman, C.E.G.B., was by general consent regarded as one of the best of its kind and occasional interpositions by the President helped to

Lord Chandos with Mr. N. H. Tomblin, the Convention secretary, and Mrs. Tomblin.

make it one of the liveliest. Among the many points made by speakers was one by Mr. Brown that if the manufacturers were going to lose money on the nuclear power stations so was the Generating Board whose loss would amount to millions. Mr. A. N. Irens, chairman of the South Western Electricity Board, after describing a sort of Pilgrim's Progress of the electrical industry, stressed that reliability of supply was more important than cost.

Both Mr. Irens and a later speaker (Dr. D. S. McIlhagger) referred to the possibilities of using underground cables ; Dr. McIlhagger thought that " undergrounding " might be a natural result from the use of longer and larger insulator strings as voltage rose. The abstracts of Mr. Nelson's paper and the other three Convention papers appear in later pages ; reports of the discussion and final proceedings will be published in next week's issue.

A vote of thanks was accorded to Mr. Nelson on the proposition of Mr. Norman Elliott and, in closing the session, Lord Chandos announced that Sir John Pickles, who had been taken suddenly ill on the previous day, was making a good recovery and hoped to be present on Thursday to be installed as the next President.

E.A.W. Luncheon

The customary Convention luncheon arranged by the Electrical Association for Women was held in the Pavilion under the chairmanship of Viscountess Kilmuir, president of the E.A.W. In proposing the toast " The County Borough of Bournemouth " Lady Kilmuir said that it gave them particular pleasure to have a lady Mayor as their guest. It was an indication of the part women were now playing in public affairs. Electrical equipment had enabled many more women to get out into public life and it had given them more leisure. Bournemouth provided delightful conditions for a conference.

In a graceful reply the Mayor (Councillor Mrs. Bicknell) said that it was an especial pleasure to her that her first response as Mayor to such a toast was to a women's organisation. She sent a personal message to Sir John Pickles hoping for his speedy recovery from his indisposition.

Mrs. H. S. Davidson, a member of the National Executive Committee of the Association, proposed the toast of the Convention. She said that for 35 years the E.A.W. had been giving a well-informed opinion on electricity in all its forms, as well as upon other matters. The Convention brought members of all sections of the industry together in personal contacts—a most valuable function.

Replying to the toast, Lord Chandos assured his audience that the E.A.W. was very popular with him, as a manufacturer of domestic appliances. He thought very highly of housecraft advisers, some of whom were employed by his organisation.

Electricity Supply

The afternoon session was devoted to the presentation and discussion of Mr. C. Robertson King's paper, " The New Horizon—Electricity Supply." The discussion which followed was both stimulating and informative, it being generally agreed that the paper constituted a good intellectual meal. When Mr. King referred to the present shortage of technologists and technicians, he said that there were thousands of vacant posts for such men in the supply industry. However, the opinion was put forward that the estimates for future requirements might tend to be too high and in a few years time there was likely to be an embarrassing surplus. One speaker felt that before the end of the present decade a brake would have to be put on scientific and technological education.

When the topic of amenities arose it was suggested that the only really satisfactory solution was to " underground " the cables, but, as an alternative, it might be feasible to transport the coal and do away with transmission lines altogether, since no overhead transmission system was justifiable, economically, for peak load operation. On the generating side British plant performance was as good as any in the world and last winter a plant availability of 93% was achieved. Power stations were notoriously inefficient, and something fundamental had to be done to remedy this. Incremental increases were no longer good enough—an entirely new approach to generation was required.

Later Proceedings

On Wednesday morning the third paper— " The New Horizon—Electrical Exports," by Mr. E. V. Small (Chairman, B.E.A.M.A. Export Panel) was read and discussed. During the morning the ladies were entertained by Lady Chandos at the Royal Bath Hotel. At the afternoon session Mr. T. E. Daniel (immediate past-chairman, E.D.A.) presented his paper, " The New Horizon—Electricity in the Home." The annual dinner was held at the Pavilion on Wednesday evening, the Marquess of Salisbury being the principal guest.

At the Electrical Forum on Thursday morning the panel of experts consisted of Miss Mary George (director, E.A.W.), Mr. A. R. Cooper (C.E.G.B.), Mr. Norman Elliott (chairman, South Eastern Electricity Board) and Mr. S. F. Steward (director, B.E.A.M.A.). The annual general meeting which followed closed the Convention.

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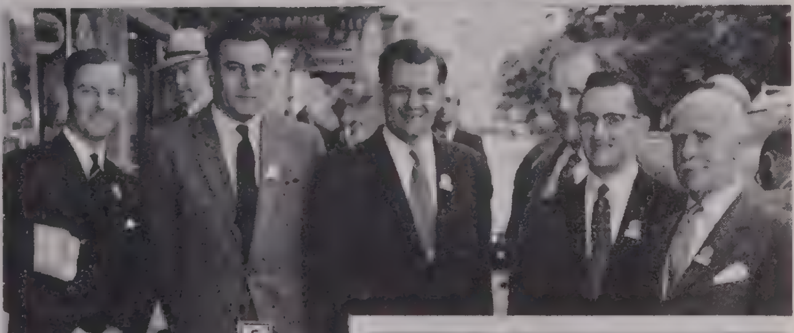
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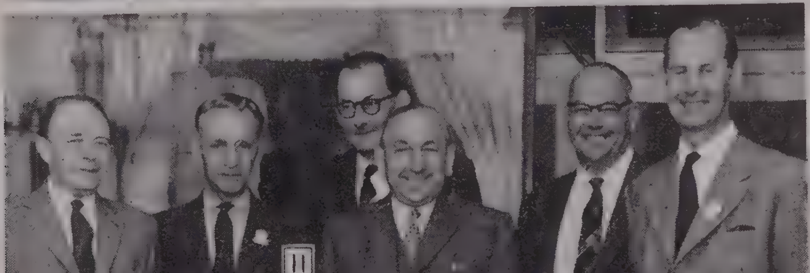
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1. Messrs. A. H. Stafford, H. Marriott and L. J. Luffingham with Dr. R. F. H. Last. 2. Messrs. C. Booth and T. E. Daniel. 3. Messrs. F. J. Godfrey and K. M. Briggs. 4. Messrs. C. W. Flint, C. A. French and A. H. Kenyon. 5. Messrs. R. D. Thomas, C. E. Donovan, H. Millyard, S. C. Harling, N. Walsh and R. M. Broadfoot. 6. Messrs. H. B. Dreyfus, S. C. Riggott, E. A. Burton, F. H. Birch and W. J. A. Painter. 7. Mr. R. C. Mathias and Mrs. E. M. Price. 8. Mr. E. J. Turner and Sir Christopher Hinton. 9. Mr. C. D. Gardiner, Mr. and Mrs. J. F. Elphick and Mr. L. G. Moser. 10. Messrs. F. W. Skelcher and R. L. Batley. 11. Messrs. L. Parsons, F. G. Copland, W. A. Coggins, A. G. Evans, F. L. Walkley and C. E. Bentley. 12. Lord Strathclyde and Mr. C. L. C. Allan.

THE NEW HORIZON

LORD CHANDOS SURVEYS THE ELECTRICAL PROSPECT

QUOTING Mr. R. A. Butler's statement in 1954 that our objective should be to double the standard of life in this country in twenty-five years, Lord Chandos, in his presidential address, said that progress towards that goal so far showed that it was by no means impossible of attainment.

Broadly speaking, he said, the standard of life could not be doubled without doubling the demand for electricity or its equivalent. That meant that twenty-five years hence the electricity supply industry would be using 100 million tons of coal or its equivalent per annum, apart from possible new outlets for electricity. Therefore the Central Electricity Generating Board was wise to persist in its long-term programme of nuclear power stations. The newest of these stations, after allowing for the amortisation of capital, would produce energy at equal cost to a conventional power station if the latter had to buy coal at as much as £4 a ton. Now pit-head thermal stations paid £3 5s. a ton so that the economic gap could be expressed as about 15s. a ton. Striking improvements had already been made in the capital cost of nuclear stations and before long it would be below £100/kW of installed capacity.

Through the increase in the size of generating sets the kW cost had been reduced from about £65 twelve years ago to below £39 today. A truly enterprising and imaginative policy by a public authority backed up by vigorous research and development by a vigorous industry had paid the nation well.

There had, however, been certain marked repercussions on the manufacturing industry. The number of man-hours involved in producing two large sets of a total of 850 MW was perhaps not more than 70 per cent of the man-hours required in making fourteen 60 MW sets. Capacity to produce had gone up by about 50 per cent with only trifling additions to the machine tools and floor space employed.

The five main manufacturers of heavy power plant in this country had a capacity of not less than 7,000 MW a year. The probable demand in this country might be put at 2,750 MW a year, leaving 4,250 MW to be exported. If the plants had to work at anything notably below 7,000 MW a year the industry would feel the pinch, but they might well add another 500 MW without embarrassment to their deliveries. These sets contained a high proportion of skill and manual labour and if the general cost of these skills rose above that of our competitors we should not be able to maintain employment at its present level.

To a large degree exports depended upon the development of power in the under-developed countries and here we ran into financial problems. During the last year or two the tendency of the United States to tie credits to American manufacturers had become a significant threat to the volume of our exports.

Authorities in the United States pursued the principle that orders were placed with domestic manufacturers if their prices were no more than 6 per cent, or in some cases 12 per cent, above the prices quoted by foreign companies. Lord Chandos said he would be inclined to think that there was some flexibility in these arrangements.

There were other dangers such as the granting of credits to un-creditworthy countries which hoped to industrialise their economies but were likely to buy their power stations at considerably below the cost of the cheapest manufacturer in the outside world. This, said the President, was no tribute to the intelligence of either our financial agencies or of the international electrical industry.

Was it not better for the under-developed countries that the advanced countries should spend their money in further development in man's conquest over the material world at the expense of some immediate lending abroad? Such a policy should enable advanced countries to earn larger surpluses with which to finance under-developed countries and provide more new designs and processes and new sources of wealth to hand on to those countries. Our available funds must be directed towards preventing starvation of the population of under-developed countries, although it would be nice to be able to invest capital too.

There was a general shortage of capital. We were struggling to prevent inflation, i.e. increased costs and prices without increased production, but at long term the volume of credit which we were creating against the ever-accelerating power to produce wealth was inadequate. The Industrial Revolution was not solely due to the advances made by scientists and engineers; the momentum was greatly accelerated by money factors, such as the gold discoveries in California and in South Africa. It might be thought that this led to the conclusion that the price of gold should be raised. He was not necessarily advocating this, but we should be aware of the danger of under-estimating the amount of currency and credit necessary to keep the world's monetary system in balance.

After referring to the papers to be read at the Convention, Lord Chandos turned to the subject of electricity in the home. He said that many women were now employed in industry where physical effort was reduced by mechanisation and automation. Was it sensible, then, that when a woman left the shop floor she should have to take a scrubbing brush to her own floor or, if there was a swingeing purchase tax on washing machines, she should have to employ the clothes-washing methods of her great-grandmother?

Of late a wiser policy had been pursued and although there was still a heavy purchase tax on domestic appliances, in contrast to investment allowances for modern factory appliances, the demand had come to stay. The United States showed the potentialities. One striking feature of the electrical industry was the mounting use of fractional h.p. motors, in domestic appliances, machine tools and business machines.

Alderman L. G. Ludlow, Mr. F. Kenyon and Lord Citrine

Mr. W. J. Brizell, Mr. D. H. Kendon and Mrs. Brizell

Factories were far better lighted than they were ten years ago, but that advance had not been carried into the home to the same extent. Light was also one of the finest selling media. There was a great scope in the lighting field.

Communications were one of the causes of the wind of change which was blowing in many parts of the world. The President said he believed that we had already adjusted ourselves to the main differences which modern communications had brought. After a passing reference to railways, saying that diesel-electric and electric locomotives would rapidly become universal, Lord Chandos said that the electronic telephone exchange had become a fact although it would probably be many years before these exchanges were used throughout the country. He also referred to the solution of the long-distance submarine telephony problem by the repeater, and to developments in television.

In the concluding section of his address Lord Chandos said that we had to face the fact that the European Common Market would throw up some large industrial amalgamations with a domestic market larger than we could hope to attain in this country or even in the European Free Trade Area. We must always be in the van of industrial progress, yet it was true that some of our shortage of technical manpower was because we were wasting or misusing it. He instanced the case of four tenders for one nuclear power station at a cost of perhaps £200,000 per tender, thus wasting £600,000 each time tenders were made. Worse, there were four teams of highly qualified engineers only one of which could be successful. This waste extended far beyond nuclear power stations into all kinds of research and development, whether in transistors, semiconductors, conventional generating plant, transformers, switchgear and so forth.

We must all consciously try to build up among the leading manufacturers more mutual confidence and, without undermining competition, to combine our research, particularly fundamental research, over a wide field. He had found his competitors " far from sub-human," much more agreeable than he had thought, and with a wider outlook than that with which he had credited them.

Lord Chandos concluded by expressing his conviction that there was no industry which offered greater opportunities to young men or which would make a greater contribution to man's control over the material than the industry represented at the Convention.

Electrical Manufacture

WHERE THE FUTURE LIES

By **H. G. NELSON**, M.I.C.E., M.I.Mech.E., M.I.E.E.*

At last Tuesday morning's session Mr. Nelson presented his paper on electrical manufacture. He began by saying that electrical manufacturing was one of the best industries in the United Kingdom, employing more than 750,000 people at the beginning of this year. A major responsibility rested upon the management of the companies concerned to provide suitable employment for these people. This meant that manufacturers must be constantly looking ahead, planning to execute the work already entrusted to them, forecasting the new work that would be coming their way and considering how best to use the resources available to them and what new facilities they would be establishing.

The real cost of electricity in comparison with other fuels was still steadily decreasing. In the next fifteen years this would mean a great increase in the number of domestic electrical appliances, our modern servants, and a move towards the all-electric centrally heated house. In recent years there had been a vast growth of spending on goods for the home rather than on " beer and 'baccy " and the effect of this on the electrical manufacturing industry was that an increasing amount of its business was in the mass production field. The capital investment represented by mass production lines was very large so there was an obvious need for accurate forecasting of the housewife's requirements.

Apart from direct application in the home, abundant supplies of cheap electricity contributed greatly to improving living standards through commercial and industrial application. The electrical manufacturers were concerned not only with making electrical equipment but also with their own processes, and, like all other industries, they were very much dependent upon electricity. Electricity featured in industry in three main ways: first, as a processing element; second, as a source of power; and, third, as means of control. Of the process use of electricity, the outstanding example was the production of aluminium, but a more modern example was that of uranium enrichment in which even greater quantities of electricity were used to produce the end product.

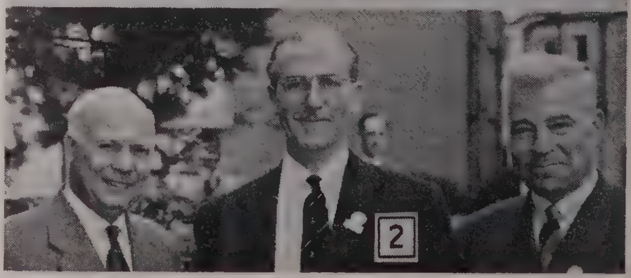
The second application of electricity to industry was for the replacement of muscle power and an outstanding example was to be found in coal mining where the horsepower per ton of coal raised had increased by 50 per cent per decade.

The third application was in the control function where it ranged from the simple automatic lift through the more complicated systems for automatic mine hoists to the complex interconnections and systems applied to multi-stand steel mills, automatic control or chemical process plant controls. The greatest innovation now unfolding was the linking of electronic data processing to control. In the steel industry, for example, a modern rolling mill utilised vast quantities of power controlled by a single operator.

In future, the industrial uses of electricity as a processing element would be extended for the introduction of new materials, particularly metals, on which so much technical development depended. It would also be used increasingly not only for power drives in industry, agriculture and transport, but as a major control element. Automatic techniques would be applied to manufacturing processes and the making of more accurate business decisions—without dispensing with the manager.

The generation of cheap electricity would obviously demand larger generating units in future; the largest single-shaft sets at present on order for use in this country were of 350 MW capacity and these would be running by 1964. By 1963 cross-compound double-shaft sets of 550 MW were expected to be commissioned. If the post-war trends continued in the future, they would have 1,000 MW single-shaft sets in operation by 1970 and continued extrapolation at this rate would imply 4,000 MW sets by 1980. However, they could not see their way to designing a single generator larger than 550-600 MW at present, the limits being imposed by transport considerations and the strength of end-bells. Taking all the various factors into account, and assuming advances in techniques but no revolutionary discoveries, the possibility might be envisaged of cross-compound double-shaft sets of 2,000 MW capacity coming into operation during the 1970's.

From the point of view of fuel consumption the economic advantage was with nuclear power stations and



1. Messrs. T. M. Ayres, C. D. Gardiner and D. G. Brown. 2. Messrs. R. E. Cornish, C. E. L. Anderson and C. W. McLellan

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* Managing Director, English Electric Co., Ltd.

1. Councillor J. Grainger and Mr. Norman Elliott. 2. Mr. and Mrs. W. N. C. Clinch. 3. Mr. and Mrs. C. Robertson King. 4. Mr. and Mrs. C. T. Melling, Mrs. R. A. Finn and Mr. and Mrs. W. S. Lewis. 5. Mr. and Mrs. D. Bellamy with Councillor and Mrs. W. Leach

the long-term trends indicated a steady decline in the price of uranium and an increase in the price of coal. It was reasonable to suppose that within ten years base load would be met more cheaply from nuclear than coal-field power stations. Despite this, however, it was not until the end of this century that steam turbines were likely to be replaced by some form of direct electricity generation.

The increase in demand for electrical energy would necessitate higher-voltage transmission systems, with 500 kV as the next logical step in the United Kingdom, and 750 kV or more in many overseas countries. All these developments would have a profound effect upon the electrical manufacturing industry itself. Most of the indicated trends imposed on the electrical manufacturer a very heavy outlay of capital expenditure and a high ratio of overheads to direct expenditure. This would have several effects. First, the industrial manager would have to devote much more time and effort to studying and controlling his indirect expenditure and there would be a trend for the control of direct operations to become more mechanised.

Second, companies would be faced with the problem that the increasing size of individual units would mean that there was not enough business to support the number of companies previously operating in the field, and this would dictate some serious rethinking on the structure of the industry. The high costs of development would also limit the number of design teams which could be supported.

Third, the direct play of free competition in the classical sense was no longer realistic and if there was to be a reasonable assurance of continuity of employment for workpeople and staff and of continuity of savings to meet the high cost of the capital investment and development needed, there must be a tendency to move towards various alternative solutions—collaboration between competing manufacturers on price, price negotiation between a customer and a chosen supplier, or the amalgamation of companies into larger groups. Another aspect of higher capital investment in industry was the need to work plant for longer hours and the answer might well be in the extension of shiftwork.

The electrical industry was the second largest exporting industry in the United Kingdom but as more overseas territories set up local manufacturing plants there would be a shift in the pattern of exports. Britain would export more units of greater size and complexity and would arrange for local manufacture of a wide range of components for them.

1. Sir Isaac and Lady Hayward and Mr. A. B. Catling. 2. Mr. E. K. Richmond, Alderman P. Buchanan and Mr. F. Groombridge

ELECTRICITY SUPPLY PROSPECTS

Possible New Sources of Power

By C. R. KING, C.B.E., Companion I.E.E., M.Inst.F.*

AFTER reviewing the present position of electricity supply in England and Wales, Mr. King turned to probable developments over the next five years, for which detailed plans had been approved, and indicated likely trends thereafter. Although no slackening in the average rate of increase of consumption of 7 per cent per annum (cumulative) over the past thirty years was yet apparent, he stated, estimates up to 1967-68 allowed for annual growths of 6·5 per cent in peak demand and 7·5 per cent in kWh, showing 0·5 per cent improvement in load factor each year.

By 1964 individual power station capacities in some cases would have been increased up to the 1,500 MW planned for Drakelow "C," and two sites in Northumberland could accommodate 2,000 MW for later programmes. Drakelow "C" and Blyth "B" stations would have 350 MW sets, the largest single-shaft units yet designed in this country. Super-critical pressures might be introduced in further units in Drakelow "C." Next year the first large pumped storage plant (300 MW) in Britain at Ffestiniog and the Berkeley and Bradwell nuclear stations would be due for commissioning.

The grid peak demand on 14th January last of 23,089 MW under slightly worse conditions than "average cold spell" left a margin in output capacity of 416 MW. Had the weather been of "extreme severity" the increase in demand of about 1,200 MW would have necessitated voltage reduction. Improved peak availability of plant recently from 88 to 90 per cent was equivalent to over 650 MW in the 1964 programme.

Fuel consumption by 1964-65 was expected to be in excess of the 1958-59 figures by eight million tons of coal, making the total 50 million tons, one million tons of the coal equivalent in oil to reach 4·1 million tons, and five million tons of coal equivalent in nuclear energy. By then the average thermal efficiency of conventional plant was expected to be 29·6 per cent (compared with 26·1 per cent last year), Blyth "B" (275 MW units) and Thorpe Marsh (550 MW units) leading with 36 and 36·5 per cent. The last named would cost about £40 per kW installed compared with £50 for stations commissioned twelve years ago, in spite of a rise of prices and wage rates of more than 70 per cent. About 0·7 employees per 1,000 kW were engaged in the most recent stations (compared with 2·8 twelve years ago) but would be only 0·3 to 0·4 in conventional stations to be commissioned within the next two or three years owing to the use of large generating units and to the greater amount of instrumentation and electronic control equipment, as exemplified by the boilers in Little Barford "B." Remote control of small local stations, such as the 3 MW gas turbine at Princetown (started 1959), serving as peak or

1. Messrs. A. L. Cramb and A. H. Frampton. 2. Mr. and Mrs. J. B. Woodeson, Mr. A. Law and Mr. and Mrs. K. J. McKillop. 3. Mr. D. Bennion Browne, Mrs. W. R. Clarkson, Mr. A. F. Plummer, Mrs. Browne, the Hon. Mrs. A. F. Plummer, Mr. W. R. Clarkson and Mr. and Mrs. E. G. Plucknett

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* Chairman, Electricity Council.

Mr. C. Robertson King and Mr. R. A. Finn

standby units, might be more economic in some cases than reinforcing distribution lines.

Five nuclear stations (2,075 MW sent out in total) were due for commissioning before the end of 1964 in England and Wales, and would then provide 10 per cent of the C.E.G.B.'s total output. A sixth (550 MW) at Sizewell might be available in 1965. Two others, if authorised by the Minister of Power, would bring the total nuclear output capacity to 4,623 MW by the end of 1966. These eight stations were expected to be of the Calder Hall (Magnox) type, but the more efficient "advanced gas-cooled reactor" might become available in the late 1960's, followed in the early 1970's by a commercial fast breeder reactor. Within the lifetime of the next generation the thermo-nuclear process (based on the energy of fusion by combination of particles of deuterium to form helium) was a possibility.

Pumped storage appeared to be the only practicable large-scale means of energy storage today, but its potentiality in England and Wales and Southern Scotland was not more than 2,000 MW. Chemical energy storage (e.g. the fuel cell) was now reaching a stage for consideration where small amounts of local power were required, as in some forms of traction; its efficiency was from 60 to 70 per cent and it could use off-peak power for electrolysis of water to produce the necessary hydrogen and oxygen. Compressed air could be stored and recovered, as could also liquefied methane, for use in a gas turbine. There was also great scope for the off-peak-charged battery-driven vehicle, the number of which in all had increased by 60 per cent within the last ten years. Preliminary experiments were proceeding in the U.S.A. (the magneto-hydrodynamic project) for generating electricity without boilers and turbo-generators; this was based on the ability of gas flowing across a magnetic field to produce electricity from anodes inserted in it.

For main transmission capital expenditure (£30·8 million in 1958-59) would reach £57 million in 1965-66. During the five years that the C.E.G.B. 275 kV system had been connected with that of the South of Scotland Board, the saving in running costs had averaged £200,000 a year. In 1964-65 the electrical energy sent from the Birmingham area to the Thames area would be equivalent to 7½ million tons of coal. Certain sections of the supergrid had been designed for conversion to 380 kV, which would carry 40 per cent more power than 275 kV, and later probably to about 500 kV to carry four times more than the 275 kV lines. It could well be that within the next decade or two d.c. would be considered to bring power to England from pumped storage in North Scotland.

Regarding primary distribution, higher voltages would be needed by the Area Boards. Increasing use would be made of auto-reclosure of circuit-breakers and of mobile radio to mitigate the effects of transient disturbances to supply in rural areas. Plastic-insulated mains cable was now coming into use and should be less expensive owing to the elimination of the metallic sheath required by impregnated-paper-insulated cables and to simpler jointing. The total capital expenditure of the Area Boards (£38 million in 1958-59) was estimated at £115 million in 1965-66.

With the completion of the present rural development programme by 1963, about 85 per cent of farms, 90 per cent of other rural premises and 95 per cent of all families in the land would be afforded an electricity supply. Consequently the rate of connection of new domestic consumers would begin to fall. Electrical road transport was declining and change to public supply of private generation would add less to load growth than hitherto. On the other hand, improved living standards, more intensive and extensive public and commercial services (e.g. railways), and greater industrial output per operative would tend to increase electricity requirements and might even increase the overall rate of progress. Electro-heat was now extensively used for high-value processes in industry and was being increasingly applied to an intermediate sector, but for the preparation of raw materials its use was only just beginning. The mass production of ordinary carbon steels by arc furnaces was illustrated by an electric steel-making plant in Sheffield which was due to start up in 1963; its capacity would be well over one million ingot tons and it would require 750 million kWh a year; it was likely to be a forerunner of other similar large-scale installations and perhaps ore smelting would one day be feasible. To ensure the translation of electrical prospects to reality would require the right type of leaders and the right type of men (and also of women), sufficient in quantity as in quality, to follow their inspiration.

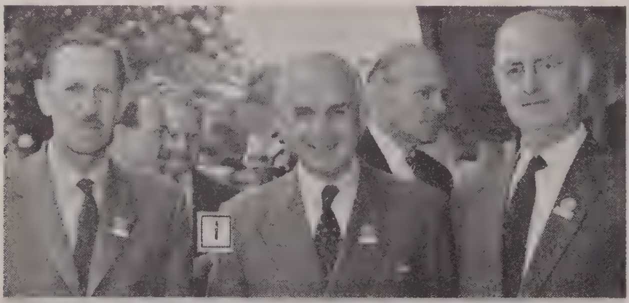
Messrs. H. D. B. Wood, S. N. Boyne and P. Sydney

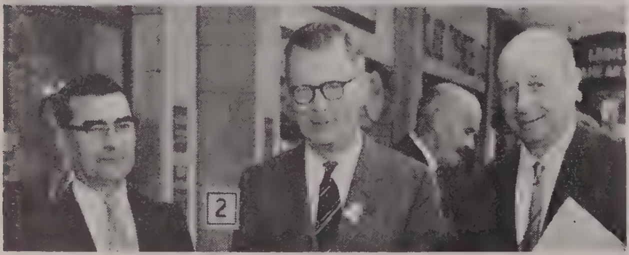
ELECTRICAL EXPORTS

By E. V. SMALL*

CO-OPERATION IN COMPLETE PROJECTS

A DEMAND for new thought and a clear directive to replace the aimless exhortations to British industrialists to increase exports was made by Mr. Small in his paper "The New Horizon—Electrical Export" at Wednesday morning's session. He questioned whether there was any clear understanding in the minds of those able to control Government and industrial action as to what the country was required to do in the future to bring about a satisfactory economic position and whether to do so needed a deliberate manipulation of industrial activities.





1. Messrs. W. J. Bamford, W. B. Shannon and J. L. Ferns.
2. Messrs. P. J. Field, W. H. C. Pilling and R. E. Wacher

The constant exhortation on all sides to export more and more seemed to lack any sense of direction and to have an undertone of inferiority complex, as if to say that only by shouting loudly and constantly could industry be bludgeoned into doing something which it would not otherwise do in its own interests. It was supported by the feeling, existing in many sections of industry, that export business was taken, if not as a favour to the nation, then as a standby operation, to fill in gaps in home demand. In looking to the "New Horizon" they had to establish clearly the status of export in each industry, down to the individual manufacturer, so that the export side of any business was treated as the equal of the home side, and not as a poor relation. Equality, Mr. Small explained, did not mean that a manufacturer must be prepared to export as much as he sold in the home market, but it should mean that the company had a policy which established a general ratio between export and home business, thus enabling those responsible for obtaining export business to take corresponding forward action in the reasonable certainty that when the time came for decisions the full support of the factory organisation would be forthcoming.

A rigid quota system for export was neither desirable nor practicable, but a target could be found, based not on sentiment or Government and other exhortations, but on all the pointers leading to correct conclusions and this target would be justifiable at a percentage considerably higher than that achieved in the past with export "taking its chance." When the improved conditions under which the electrical industry was now operating were considered, the level of exports at around 20 per cent of production was too low, and Mr. Small suggested that a figure of 25 per cent was not an impossible target.

After touching on the present methods of financing large overseas projects, Mr. Small said there was still a very wide field of credit demand that could only be satisfied by the utilisation of private funds. Unfortunately the accepted method of arranging credit, by Government guarantee, effectively turned the manufacturer into a finance broker and for this reason many firms had fallen out of the export race. Project finance must be divorced from manufacture. Mr. Small suggested that with Government support the banks should be urged to form syndicates to go abroad and look for sound overseas projects that needed finance. Funds for the 15 to 20 years' investment needed could be obtained from insurance companies and other institutions.

An equivalent industrial syndicate would be required to back the financial negotiations and often to take the lead. This would enable the construction of the project to go forward as a unified operation. There should, however, be no fixed pattern but a constantly changing *ad hoc* grouping of different parties according to circumstances and requirements. Their Continental competitors had gained an advantage in taking the lead, nearly always through a financial approach, in offering complete co-ordinated schemes for the financing and construction of large projects. Cases had occurred where contracts had been awarded to Continental banking syndicates solely on the offer of finance to be used specifically on stated power projects, leaving the co-ordinated contracts to be negotiated at leisure afterwards within the total sum agreed. The day had passed when British manufacturers could afford to chase orders for individual pieces of apparatus. Group contracting had many advantages for both the supplier and customer, and Mr. Small thought that both consulting engineers and smaller manufacturers would benefit from its extension.

In this country there were more companies of standing within each industry than was the case elsewhere and though this was a source of strength in the past it could be a source of weakness in a shrinking market for standard manufactured products. Though economic pressure might in the long run bring about the required changes in the structure of the industry, the present multiplicity of efforts to secure export business was wasteful and involved a loss of impact. Much more could be done by closer contacts between manufacturers to mitigate the bad effects and strengthen collective export efforts. In this connection Mr. Small paid tribute to the work of the B.E.A.M.A. at home and overseas and stressed the importance of manufacturers and the supply industry giving consideration to export requirements when designing for the home market, even though this might involve reducing the pace of development.

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* Joint Managing Director, A.E.I. Export, Ltd., and Chairman, B.E.A.M.A. Export Panel.

The calibre of men required for service abroad was different from those successful in the past, since they would have to take charge of sizeable operations and identify themselves completely with the country to which they were assigned. The agent representative was fast disappearing, and permanent representation, though still needed, could be decided against the increasing ability to fly specialists to all parts of the world.

Once the process of local manufacture had been commenced the inevitable end was for it to become completely independent of its parents and in many cases compete with them outside its own country. For this reason, Mr. Small insisted that they must approach the problem of overseas manufacture as one of straight business, unblurred by the sentiment that had warped the judgment of many Commonwealth ventures. They must not, however, change from manufacturing companies into finance houses and right from the start the overseas operation must make some return to the parent for services rendered. After discussing how subsidiaries might be set up, and indicating certain safeguards, Mr. Small said that in the new pattern of exports there would be an increasing sale of knowledge as distinct from goods. This meant maintaining our leading position in research and development.

Electricity in the Home

INTENSIVE DEVELOPMENTS FORESHADOWED

By T. E. DANIEL, M.Eng., M.I.Mech.E., M.I.E.E.*

In the final paper of the Convention, presented at Wednesday afternoon's session, Mr. Daniel introduced his subject, "Electricity in the Home," by observing that flights of fancy were all very well but when attempting to envisage the evolution of electrical equipment or the development of new appliances, the electrical industry would probably do well to limit its "horizons" to the end of the 1960's or thereabouts. It was, he said, not just a question of what was technically possible, but more one of exploring what form the pattern of living was likely to assume.

The electric cooker he described as being the key appliance on which the domestic load was built. The fear of supply failures and the uncertainty as to running costs were now largely dispelled. As for the illusion that electric cooking was too slow, the latest radiant hotplates and enclosed boiling plate developments proved that there was no longer need to have any fear on that score, and he looked forward to a greater share of the total cooker market.

1. *Mr. P. M. Miln, Mr. F. J. Marron and Mrs. Miln.* 2. *Mr. and Mrs. H. C. Timewell*

With regard to water heating, he thought that the task had changed from one of selling the idea of installing electricity for water heating to one of educating users in the way to get the best service from hot water systems. He suggested that builders might seriously consider making provision for installing hot water vessels of 50 gal capacity so that the water-heating load could be entirely off-peak. There was, he said, scope for sink water heaters with higher loadings and greater output. The demand was at present limited by the generally accepted desire not to exceed a loading of 3 kW. In the next few years many supply networks would be capable of accepting higher loads than this and it would be wise to prepare now to make plans for water heaters with loads of perhaps 5 kW. Preparations should also be made for the use of 25 A plugs and sockets for domestic purposes.

The Clean Air Act, said Mr. Daniel, was having the effect of limiting the use of solid fuel in its raw state and many householders were changing to the refined fuel—electricity. He also spoke of the industry's reluctance to encourage all-electric schemes for large local authority housing estates because of the heavy capital investment on distribution networks and he asked whether this was not a short-sighted view. The alternative was to accept load as it came, but it might well be that distribution systems coming into use now would not be able to cater for the load in a few years' time because of the large

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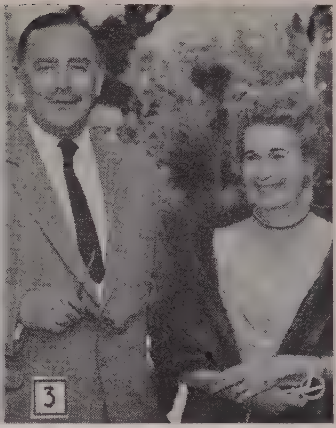
*Past-chairman of E.D.A. and Chairman, North Western Electricity Board.



1. *Mr. and Mrs. T. Whitehouse.* **2.** *Messrs. T. M. Ayres, J. Foster Beaver and E. K. Richmond.* **3.** *Mr. and Mrs. E. J. Wade*

concentration of portable heating appliances. He suggested it might be better to encourage the use of floor warming on such estates, so as to have some measure of influence over the load characteristics. There was also a need to examine other ways of developing storage heating systems for existing property and in this connection the use of ceiling heating seemed to offer possibilities. A lightweight heat storage medium which could be fixed below existing ceilings had possibilities.

The speaker thought there was little doubt that in the next few years the uses for electricity in the home would be more ambitious. More extensive use of infra-red heaters introduced the possibility of building these heaters into the structures of houses to create local comfort zones. He envisaged the time when there might be a central control panel whereby heating requirements for the day ahead could be programmed and from then onwards left to take care of itself. In considering the case for electric heating in the home, the same considerations should apply as for commercial and industrial premises: the decision should be based on a true balance of total costs, including capital charges, as well as running costs. There was little doubt that an electric heating installation was lower in capital cost than its competitors. This applied particularly in new premises where a floor warming installation might cost as little as 2s per sq ft of floor area.

After dealing with the three basic uses of electricity in the home, Mr. Daniel examined trends in some of the other fields. Many thousands still had very small kitchens and had to resort to small refrigerators which, whilst offering protection for the essential products, did not give the storage space that was really required. He thought that more compact models would be required as the saturation factor grew. It was, he said, interesting to learn of the possibility of a refrigerator using semiconductor devices, which would possibly reduce the amount of space now taken up by the cooling unit. On the other hand, there would also be an increasing demand for facilities for dealing with frozen foods, either as part of an existing refrigerator or as a separate unit.

The electric washing machine was now firmly established but it seemed evident that most housewives realised the need for indoor drying facilities. Properly designed drying cupboards should be part of new building plans. The power-driven wringer would perhaps be superseded in the larger kitchens by a spin dryer and the drying cabinet might also be succeeded by tumbler dryers. It was thought that most washing machines would be electrically heated.

In recent years, continued the author, the electrical industry had been very successful in inducing the customer to see that laundry appliances, cleaners, cookers, refrigerators, etc., were high priorities in the home, but the public was not so ready to welcome the increased electricity bills. While £50 spent on a refrigerator was considered to be something to be proud of, the spending of a similar sum on improving a wiring system was postponed and begrudged. He wondered whether this had been due to readiness to meet the public's convenience with easy terms for new appliances, but disinclination, through lack of capital, to finance the modernisation of wiring systems.

Among reasons mentioned by the author why there was not a general change to electricity in smoke control areas was the public's aversion to large quarterly bills and preference for staggered and " pay-as-you-go " fuel bills. It was not desired to over-emphasise the opportunities in smoke control areas but a study of the position served to indicate factors which retarded general domestic development. Only some of the difficulties were resolved and the retention of one main solid fuel appliance in many homes might have to be accepted.

Regarding the house of the future, Mr. Daniel said that a house, all-electric or otherwise, with comfort zones and " arctic " zones was no longer tolerable and whole-house heating was coming in progressive stages. It was, however, not easy to forecast what further developments there might be in the electric cooker field, but with the larger kitchens that were hoped for, the separation of the oven from the hob seemed to be a desirable step. The washing-up machine was slowly coming into its own, he said, and he also stressed the need for a low-priced electric incinerator for burning waste.

In an attempt to forecast just what the all-electric home might be like in ten years' time, the author, with the aid of charts, presented a list of possible electrical applications and loads. He chose a three-bedroomed house and indicated a possible installed load of about 95 kW, including about 44 kW of space heating and 10·5 kW of water heating. The consumption might be 31,700 kWh annually (20,000 kWh off peak) at a total cost of £113.

VIEWS on the NEWS

By REFLECTOR

ONE useful part of the Eastern Electricity Board's information services is a four-page newspaper, *Eastern Electricity Farmer*, produced for the agricultural community in the Area. This deals in a practical way with the many applications of electricity on the farm and smallholding. I note from the May issue which I have just been looking at that the term "farming" stretches out long arms—sufficiently long to embrace mushroom production and even lobsters. Under the heading "Lobster Farm" there is an account of methods used to keep lobsters and crawfish, caught off the west coast of Scotland and Ireland, in good condition for dispatching to the Continent. The electrical nexus is the use of four 1 h.p., 2,000 g.p.m. pumps to circulate and oxygenate the water in four large concrete tanks at Southend-on-Sea in which the crustacea are freshened up while awaiting shipment. The treatment is so successful that their claws have to be tied up to keep them from fighting.

* * *

So many complaints have been made about fumes from power stations, many of them justified, that it comes as a surprise to read of the more amenable attitude of some London municipal authorities in this matter. For this I rely on the *Westminster and Pimlico News* which says that the Westminster City Council is not pressing for new gas-washing plant to be installed at the Fulham station as no complaints have been received from residents during the last twenty years. The Chelsea and Kensington Borough Councils also think that a new plant is unnecessary. On the other hand, the newspaper says that

> "Fulham Borough Council had asked that the Gas Board should be pressed to close the station down at the earliest possible date."

No doubt that Board will be willing to oblige.

* * *

The Star (Sheffield) reports that at a local Magistrates' Court a woman admitted that she broke open her gas meter to obtain money with which to pay her electricity bill. There is a certain ambiguity about the heading: "Gas meter forced to pay Y.E.B."

* * *

Irregular intervals between electricity meter readings cause little difficulty when the consumer is on an ordinary two-part tariff. Everything comes out right in the end. When a block or "stepped" tariff is employed variations in the length of the charging period may raise a question which I had not thought of until it recently cropped up at a meeting of the East Midlands Electricity Consultative Council. If the period between readings is curtailed a consumer may not be able to reach the more favourable "block" in that period and he will not benefit from the longer period which may follow. I must say that this can only occur in the case of "small" consumers. The East Midlands Board recognises the possibility and makes an adjustment so that the primary and secondary blocks are apportioned to give a true charge. But I note that the variation from the normal span of 91 days has to be as much as 28 days before adjustment is made—which seems to be rather long.

* * *

When he presented the 1960 Design Centre Awards recently, the Duke of Edinburgh expressed the view that it was much easier to be a critic than a selector, easier to be a selector than a designer, and easier to be a designer than an enlightened and discriminating manufacturer. There will be general agreement with this, especially the final point: it is the manufacturer who has to sell the product and he cannot be blamed if he is sometimes a little cautious in accepting the designer's ideas. Some will say, no doubt, that too often his caution is excessive.

* * *

When the curfew tolls the knell of parting day Stoke Poges (in whose churchyard Gray is said to have written his *Elegy*) will continue to descend into darkness. Last week a parish meeting decided against street lighting for the village by a large majority.

* * *

Seventy years ago a German book on "The Glow Lamp" was dealt with by the *Electrical Review* (6th June, 1890) when it was stated that the author estimated the yearly production of "glow lamps" in Europe at five million, and believed that "when gas and petroleum were used only for heating and driving motors the output would become ten times greater." The reviewer remarked:—

> "The author recognises Edison as the first who gave the glow lamp practical utility; but not the first who devised its principle. The physical conditions of the glow lamp are next discussed, a subject on which the most singular errors have prevailed, and have been reproduced even in the writings of specialists. In the section on the materials for lamps, the author insists that the vegetable fibres used for the production of filaments should be free from fungi. A manufactory was for an entire week unable to produce a good lamp, because decomposing bamboo had been used for the work."

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Floor Heating and Radiator Systems

I AGREE with Mr. Hazel that there is an enormous interest in electrical central heating. With regard to other forms of heating I am sure he will agree that where radiators are used, whether water or electric, tailored to window width in any but the smallest rooms they cause overheating for those sitting near the radiator and leave it cold and draughty for those at a distance, and to overcome this it is more efficient to use several small radiators around the space, as is very often advised, than to use only one large radiator.

Even to the layman it must be obvious that an even temperature spread over the whole area as in under-floor heating must be more efficient and economic whether hot water or electricity is used, the only difference being cost. Water heating needs boilers, fuel storage and maintenance and any builder will agree that the necessary chases, ducts and cutting away for water pipes add considerably to the building costs. Quite recently under-floor electric heating installed in a small church cost nearly £2,000 less than the price quoted for water heating, not counting a large saving in the cost of building or the valuable space required by boilers and fuel storage for which the cost of the building, rent, rates and taxes, and maintenance must be added.

With reference to the meeting of the Institution of Heating and Ventilating Engineers mentioned by Mr. Hazel, I was present and agree there were very diverse views on the subject, but in my opinion most of the critics had practically no personal experience of electric floor heating and were prejudiced by the thought that all their experience of water heating would no longer be required and electric heating would put them out of business. Some heating and ventilating engineering firms with foresight have opened an electrical department to enable them to continue in business when radiator systems become redundant. I regret I cannot agree with Mr. Hazel that electric radiator systems are as low in capital cost as under-floor heating, my experience being that the radiators cost more than the under-floor cables apart from the fact that they are ugly, take up valuable floor space and are less efficient.

London, S.W.16. A. J. SPARKS.

MR. HAZEL'S letter in your issue of 20th May prompts me to reply once more in order that your readers may not be misled and may realise that at least one of the writers to whom he refers has had considerably longer experience with central heating in general than he has himself.

From the time I joined the heating department of a Swiss firm in 1922 until the time I joined E.D.A. in 1935, I was a heating and ventilating engineer in the ordinary sense of the phrase; in other words, I was engaged with all forms of hot water heating and ventilating systems. From 1935 to date, with the exception of the war period, I have worked as E.D.A.'s heating engineer.

I have travelled on the Continent and in the United States and although such things are impossible to prove, I hold the firm opinion that nothing like 95 per cent of domestic central heating is by means of hot water radiators let alone radiators "tailored to window width."

I take it that it is *domestic* heating we are talking about and not commercial and industrial? Sauce for the goose may be sauce for the gander but it's horseradish for beef and mint sauce for mutton!

Finally, I hesitate to accuse anyone of having axes to grind but I do not think that any of the critics of electric floor warming at the Institution of Heating and Ventilating Engineers' meeting would be prepared to quote for an electric floor warming installation.

London, W.C.2. E. M. ACKERY.

I SUPPORT Mr. Hazel in his plea for more field tests on methods of heating, and your readers may recollect that following my paper entitled "The Logical Approach to the Problems of Space Warming by Electricity," read before the Institution of Electrical Engineers in 1951, the Central Electricity Authority erected and tested twelve houses on their Keadby Estate, equipped with floor heating and with improved heat insulation; unquestionably, very valuable information was obtained from this experiment. But I would reject the idea of comparative tests of different methods of heating as impracticable. One must only compare like with like; one cannot compare apples with oranges on the basis of cost alone.

Heating comfort is largely a matter of personal judgment but there is little doubt that the average person likes to be warmed by at least as much radiant heat as convected heat; what Mr. Hazel calls "radiators" are, in fact, mainly convectors. Floor heating, however, gives a nice balance of convection and radiant heat and, incidentally, an equable vertical heat gradient and an absence of draughts.

Floor heating, like oil-filled "radiator" heating, is conveniently controlled by an air thermostat, shielded from direct radiation, so that at a given air temperature the floor is emitting more radiant heat than the oil-filled "radiator" and must be expected to use more electricity; but it also gives greater comfort. The heating engineer is not able to provide a simple instrument to measure comfort but, fortunately, the average householder is a good judge of heating comfort and whatever engineers may say, will follow his own judgment.

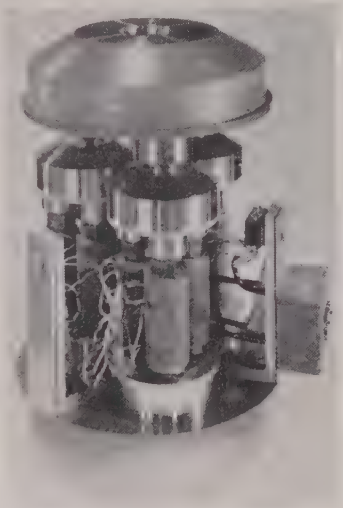
Hot-water central heating with "radiators" has been in common use from before this present century because the first cost is much less than for hot-water floor heating; continuous electric heating has become competitive only in the last decade, but the first cost of floor heating is small, far less than conventional central heating, and there seems to me no good reason why people should clutter up their rooms with " radiators."

Generally speaking, people seek the standard of heating that they can afford and if they find electric heating is too expensive it is because either they have not learnt that continuous heating is more expensive than occasional heating or that a high thermostatic setting will result in large consumption. As an enthusiast for electric heating, I am concerned that consumers should learn that it is worth paying for, and whilst I should like consumers to choose the best form of central heating, the really important consideration is that it should be electrical.

Thurnby, Leicester. D. H. Parry.

N.P.L. OPEN DAYS

New Mutual Inductance Standard on View

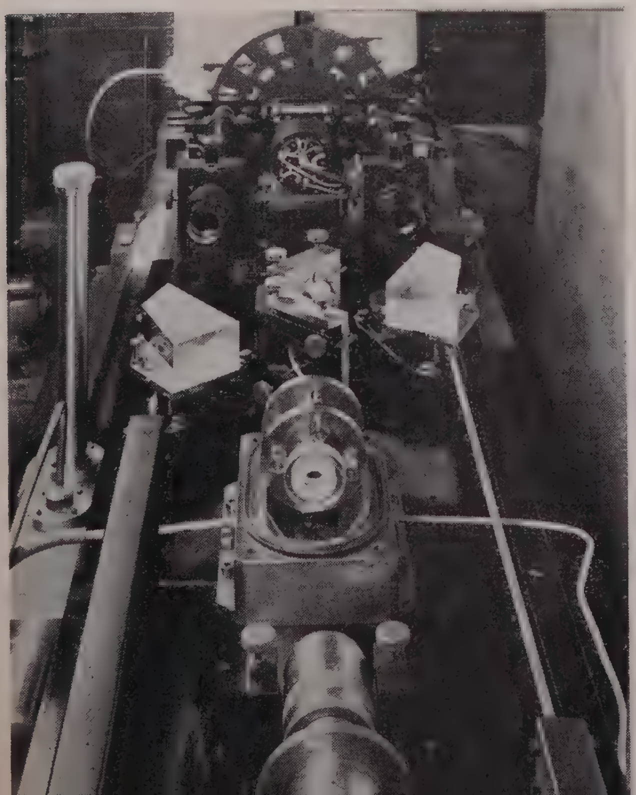


Each of the nine struts in the 450 ton force load cell has eight resistance strain gauges

A SELECTION of the year's new achievements and the regular day-to-day work of the National Physical Laboratory was on view at Teddington during last week's open days to which nearly 10,000 invitations were issued. Included among the new work were a number of items produced by the Standards Division. In a new mutual inductor the primary winding consists of two coaxial helices separated by a gap equal to their combined lengths, and the value of the standard is determined critically by the dimensions of these windings. The secondary winding is a compact, multi-turn coil in the plane mid-way between the helices, and has a mean radius such that there is no resultant field where it lies because the fields produced by currents in the primary helices cancel. This makes the value of mutual inductance relatively insensitive to small variations in the radius of the secondary.

A comparison of nearly equal wavelengths can be made by a newly developed method using the Fabry-Perot interferometer in which the interference fringes are recorded photo-electrically. The two sources whose wavelengths are to be compared are illuminated in rapid alternation and the two sets of fringes are recorded concurrently. It has been used to compare the wavelengths of green light emitted by lamps containing the single isotope, mercury 198, in measurements of the density of mercury, and is now employed in a study of the proposed new standard of length, the wavelength of the orange line emitted from a lamp containing the single isotope krypton 86. Wavelengths can be compared to a few millionths of an angström.

Two-channel Fabry-Perot photo-electric recording interferometer



A 450 ton force compression load cell incorporating nine struts has been designed for use as a secondary standard. Each strut has eight resistance strain gauges, wired to form a Wheatstone bridge circuit. The nine individual bridge circuits are supplied from a constant voltage source and out-of-balance voltage changes due to strut loading are fed to a digital voltmeter system. The maximum signal from any bridge is 25,000 μV, which must be recorded to ±5 μV. Since the voltmeter cannot give 25,000 discrete readings of 1 μV, the signals are passed to an electronic selector which feeds each channel in turn to a circuit enabling the signal to be backed off in 1,000 μV steps. The residual signal, less than 1,000 μV, is passed to a high stability d.c. amplifier and fed to a digital voltmeter which gives five-figure readings and transmits signals to a printer.

The Autonomics Division, formerly the Control Mechanisms and Electronics Division, has been carrying out work into superconductivity. Examples of superconductive computing elements were on show and there was a schematic diagram of a vacuum evaporation unit, at present in the workshops, for depositing cryotron circuits on bases up to 1½in square. It has eight stations, each with a mask and using a tantalum boat as the vapour source. Up to eight superimposed films can be deposited without breaking the vacuum.

The Autonomics Division is also at present investigating the automatic reading of magnetic characters on cheques, using systems proposed by E.M.I., Ltd., La Compagnie des Machines Bull and the American Bankers' Association.

High-Voltage Research Ending

Although negotiations are proceeding with the Central Electricity Generating Board and the Electrical Research Association for the transfer of all high-voltage work from the N.P.L., a considerable amount of work has recently been undertaken by the high-voltage laboratory of the Applied Physics Division. This includes the construction of a control unit for the remote reading of an absolute voltmeter, a report on the electrical properties of surge corona, a study of the factors affecting wet flashover in air and life tests on capacitors for an atomic energy establishment. This Division also undertakes photometric tests on filament and discharge lamps for colour temperature, luminous intensity and total output, and life tests in which batches of lamps are burnt with intermittent switching. A 15ft diameter integrating sphere is used for luminous output tests on lamps over 150 W. Accurately known neutron fluxes are necessary in reactor design and the Division has established and calibrated exactly a standard Ra-Be photo-neutron source. The measurements are based on determining the amount of radioactive ^{56}Mn produced when neutrons from the source are slowed and retained in an aqueous solution of manganese sulphate. Certain types of neutron source can now be accepted for calibration.

SCIENTIFIC AND INDUSTRIAL RESEARCH

THE annual report of the Research Council of the Department of Scientific and Industrial Research for 1959 (Cmnd. 1049, H.M. Stationery Office, price 4s 6d) was published last week. The year under review was the first in the Council's second five-year plan, and saw a considerable growth in the scale and range of the Council's activities. Important additions to the range of buildings administered by the Department were made during the year in the Ship Hydrodynamics Laboratory at Feltham (see *Electrical Review* dated 23rd October, 1959) and the Warren Spring Laboratory at Stevenage. Following a survey of D.S.I.R. laboratories in previous years, the Research Council has recently reconsidered the broad aims and functions of the stations. As a result, the Council has put before each station a limited number of clearly defined objectives chosen so as to yield the maximum national advantage from the resources available for research. The report clearly sets out the major purposes of the research stations and explains the redistribution of effort.

There was an unexpectedly large response to the announcement that, under the second five-year plan, more support would be given to universities and colleges of technology in the development of their researches. During 1959, over 360 applications for research grants totalling £3,300,000 were received (compared with 204 applications amounting to £1,350,000 in 1958). Of these, which include nuclear physics and human sciences, 295 (163 in 1958) were awarded, totalling £2,232,000 (£1,090,000). The Treasury has taken a sympathetic view of the large increase in research grants and agreed, without prejudice to the rest of the five-year plan, that the D.S.I.R. could enter into commitments for research at a substantially higher level than was planned. This level will be reviewed year by year.

Grants have been awarded during the year in accordance with the scheme for longer-term support mentioned in the 1958 report. These grants aid research projects for which no end point can at present be seen. The number of awards for post-graduate training rose during the year under review by one-fifth to 928 (777 in 1958). Over 250 advanced course studentships were awarded during the year (184 in 1958).

As mentioned earlier, the Council has concluded its survey of the Department's research stations and has issued revised instructions to the directors to guide them in their work. Provided the objectives are practical, this work should consist of basic research, applied research and development. The directors aim to ensure that the appropriate Government interests are linked as closely as possible with the stations' work and in consultation with research associations where appropriate they aim to secure financial or other co-operation from industry. One of the main purposes of the research stations is to disseminate the results of research and secure their application. Appendix 3 in the report shows how the growing resources of each station are to be allocated over its field of interest during the next financial year. The percentage distribution of effort to be applied at the National Physical Laboratory is as follows:—Aerodynamics, 19; applied physics (including the Test House), 15; basic physics, 6; control mechanisms and electronics, 8; light, 8; mathematics, 6; metallurgy, 11; ship, 11; and standards, 16.

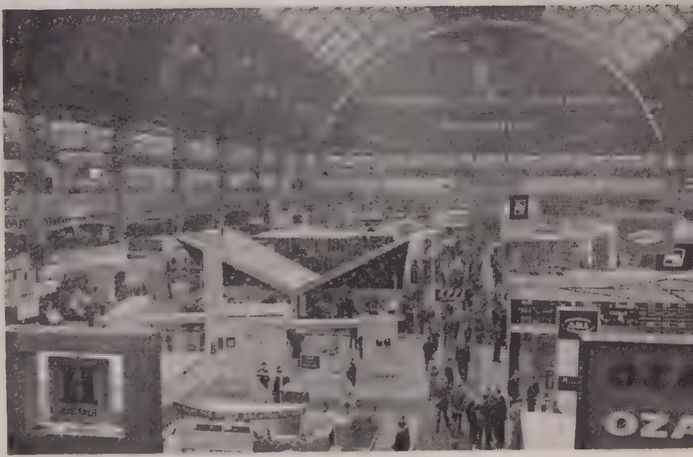
During the year the Department made a grant of £40,000 to meet the cost of a horizontal 10 MeV tandem Van de Graaf electrostatic generator for research and low-energy nuclear physics at the Nuclear Physics Research Laboratory at the University of Liverpool.

The Economics Committee has completed a survey designed to bring up to date the estimates of expenditure on industrial research and development. In 1958, the manufacturing industry is estimated to have spent a total of about £300 million on research and development; 95 per cent was on work carried out on its own premises and 5 per cent represented payments to outside research organisations. These figures do not include private industries' considerable benefactions to universities for work which is not specifically related to industrial problems.

Instruments, Electronics and Automation

Review of the International Exhibition at Olympia

National Hall



Grand Hall

On this page the opening ceremony is described and on the following pages we publish articles by specialists covering the three themes of the Exhibition. The first article deals with individual measuring instruments including electronic instruments and non-electronic components. Electronic components, including semiconductor devices, and their use in various apparatus such as computers are discussed in the second article, while the third article covers the application of electrical and electronic engineering to automatic control schemes

NEARLY 500 exhibitors, including more than 100 from overseas, displayed examples of their equipment at the third international Instruments, Electronics and Automation Exhibition, which was held last week at Olympia. The floor space occupied and the number of exhibitors taking part were twice as large as at the previous Exhibition in 1958. During the week a conference on "User Experience of Electronics in Industry" was held by the Electrical Forum for Industry.

The Exhibition was opened on Monday, 23rd May, by Lord Mills, Paymaster General and former Minister of Power, who was heralded by eight trumpeters of the Royal Household Cavalry. Lord Mills, who was introduced by Mr. Charles Hanrott, chairman of the I.E.A. Exhibition Committee, spoke of the impact which scientific and technical development was making on Britain's industrial life. It was necessary, he said, that we should be, and should seem to be, in the forefront of all scientific developments. He looked to the great manufacturing industries of this country to benefit from the progress that was being made in the automation field to increase their efficiency. Many of the goods being offered for sale today and shown at the Exhibition were not invented, let alone manufactured, ten years ago. Staple products on which we relied for our export trade were being manufactured by our customers in other countries. We should not seek to prevent that, but should encourage the underdeveloped countries to raise their standard of life. Our best customers were, in fact, working along similar lines of development to ourselves.

Lord Mills, Paymaster General, opening the Exhibition with Mr. Charles Hanrott, chairman of the I.E.A. Exhibition Committee, on his left and Mr. E. W. Semmens nearest the camera

Modern Instrument Techniques

By **H. B. WOOD**, B.Sc., A.M.I.E.E.

ELECTRICAL and electronic instruments are now used on a very large scale in practically every branch of science and engineering and, consequently, many of the applications of electrical measuring techniques are very specialised and of somewhat limited interest. The selection of the instruments reviewed in this article was made, therefore, on the basis of their appeal to electrical engineers in general, and consequently those electrical and electronic instruments which were designed for specific applications in, say, the chemical industry, have been omitted.

The most obvious trends in instrument design and construction which have emerged since the last I.E.A. Exhibition are the increased use of printed circuits and plug-in sub-units, and also the appearance of a number of transistorised instruments such as low-power oscillators, portable oscilloscopes and sound level meters, etc. In most cases, however, the transistor-operated instruments have similar specifications to the corresponding valve-operated circuits except, of course, for the power supply requirements.

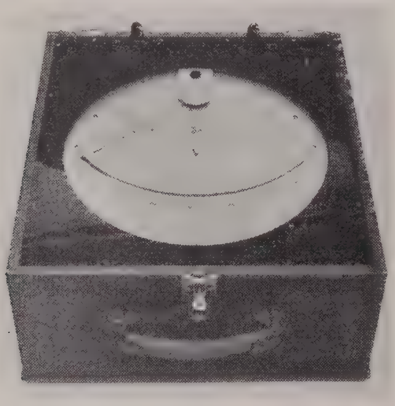


Fig. 1.—Precision electrostatic voltmeter shown by Nalder Bros. & Thompson

Indicating Instruments

The usual indicating types of sub-standard transfer instruments are the moving iron and dynamometer variety both of which suffer from the disadvantages of absorbing rather large amounts of power and of restricted frequency range. Laboratory reflecting types of electrostatic instrument are capable of extremely high accuracy, but in commercial pointer types the torque/weight ratio is rather low and therefore pivot friction assumes major importance.

Nalder Brothers & Thompson, Ltd., have overcome these difficulties and produced a precision electrostatic voltmeter having a full-scale deflection of 1,000 V and a substantially linear scale above 300 V (Fig. 1). The instrument has an input resistance approaching 2×10^{13} ohms, and consequently the power absorbed from the supply is negligible. No corrections for ambient temperature changes are necessary.

An interesting new universal valve voltmeter, type ERIC MT/3, was demonstrated by Metrix Instruments, Ltd., in which, by factory selection of the first stage valves and the use of negative feedback, the effective input resistance of the circuit can be made as high as 10^{14} ohms (Fig. 2). In this respect, therefore, the instrument performance approaches that of the ideal voltmeter, i.e. a voltmeter which does not disturb the circuit to which it is connected. The use of such a very high input resistance enables a number of unusual features to be incorporated in the design; for example, it is possible to "store" a voltage reading for up to 24 hours with only 0·5 per cent drift in the indication. This is accomplished by allowing the voltage to be stored to charge a 0·5 μF polythene dielectric capacitor which has a leakage resistance of about 10^{14} ohms. The voltmeter is then merely connected across this capacitor so that the overall time constant of the circuit is $2{\cdot}5 \times 10^7$ sec (about 291 days). The memory can be erased, of course, simply by short-circuiting the capacitor. The very high input resistance also allows an unusually wide range of resistance measurements to be made. Thus, on the "ohms" range, the meter can register up to 100 MΩ for mid-scale deflection, and measurements can be made without difficulty up to 1,000 MΩ. The use of negative feedback also allows this instrument to be used for current measurements with an effective input resistance of about 1 MΩ.

Marconi Instruments, Ltd., showed a bolometer, type TF 1202A, for measuring power in 50 ohm coaxial systems in the frequency range 500-5,000 Mc/s (Fig. 3). The instrument comprises a thermistor bridge supplied from a d.c. source, and having thermistors in two arms of the network. The power to be measured is dissipated in one of the thermistors and results in an unbalance of the bridge which was initially balanced with zero input. The magnitude of the unbalance is indicated by means of the meter on the front panel which is calibrated in terms of power. The second thermistor is used to compensate for changes in ambient temperature, etc.

Cathode-Ray Tubes and Oscilloscopes

The oscilloscope is probably the most useful single device used by the electronic engineer, and consequently a considerable amount of effort and ingenuity is employed in improving the performance of this instrument. On account of the extremely wide field of application, however, the design of a general purpose oscilloscope has become virtually impossible, and the present tendency is to produce a basic oscilloscope comprising a cathode-ray tube, power supplies, etc., and a series of plug-in Y-axis amplifiers and time base units. Thus the performance of the instrument can be changed when necessary merely by replacing the appropriate plug-in unit.

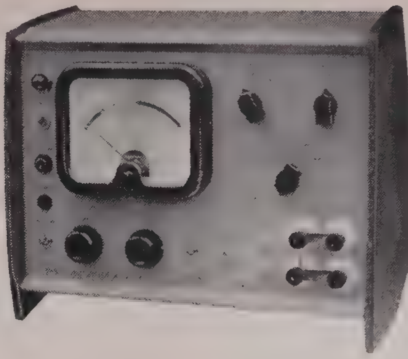


Fig. 2.—Metrix Instruments, Ltd., ERIC MT/3 valve voltmeter

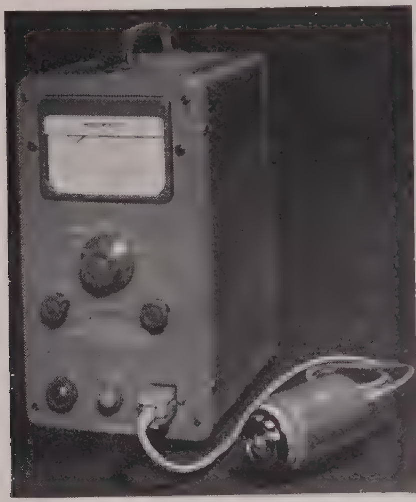


Fig. 3.—Marconi Instruments bolometer-type power meter

A good example of this technique is provided by the 1076 oscilloscope exhibited by Cossor Instruments, Ltd., in which Y amplifier units having a bandwidth from 0 to 60 Mc/s may be used to provide a deflectional sensitivity of 50 mV/cm, and time base units capable of sweep speeds ranging from 0·1 cm/sec up to 50 cm/μsec are available.

A most interesting advance in the design of cathode-ray oscilloscopes has been brought about by the invention of the infinite persistence or storage type of cathode-ray tube. This feature is obviously of immense value in the study of transient phenomena and may be expected to largely obviate the need for photography in this respect. The tube exhibited by Mullard, Ltd., comprises a phosphor screen, a storage mesh and a collector mesh, mounted in that order immediately behind the screen, and two electron guns. A third mesh is incorporated to prevent residual ions reaching the storage mesh. The storage mesh consists of a metallic backing mesh coated with a layer of insulating material which has a high secondary emission coefficient.

The first electron gun incorporates an electrostatic deflection system and is used to " write " in the form of electric signals on to the storage layer; the second, or " flood " gun, enables the storage signals to be displayed at will on the phosphor screen. As the layer is scanned by the " write " gun, the areas struck by the electron beam acquire a positive charge due to the emission of secondary electrons. The secondary electrons are prevented from returning to the storage mesh and destroying the charge by the presence of the secondary collector, which is held at a more positive potential. To display the stored information, the storage mesh is sprayed uniformly by low-velocity electrons from the " flood " gun. The " flood " electrons pass through the mesh where it is positively charged, but are repelled by the uncharged areas. Those allowed to pass through are accelerated by the higher potential which is applied to the viewing screen, and in striking the phosphor produce a trace identical with that represented by the pattern of stored charges. Erasure of the information is achieved simply by adjusting the potential of the collector mesh so that the secondary electrons return to the storage surface to neutralise the charges.

A number of firms exhibited oscilloscopes designed around infinite persistence tubes of American manufacture.

Adjustable Bandwidth Filter

The electrical engineer engaged upon development work on measurements, frequently requires a filter to remove unwanted signals or harmonics from a circuit under test, or to determine a noise spectrum, etc. Unfortunately, the requirements can be so varied that it is virtually impossible to produce a reasonably small range of filters which will be satisfactory for most purposes.

A neat solution to filter problems of this type is provided by the variable bandwidth filter, type 1465, produced by Dawe Instruments, Ltd., which comprises two independent filter units which may be connected in cascade (Fig. 4). The two filter networks, which are designed to have low-pass and high-pass frequency characteristics respectively, each have adjustable cut-off frequencies which may be set by means of controls mounted on the front panel of the instrument. A selector switch is also provided to allow either the l.p. or h.p. filter units to be connected into circuit individually or in cascade. Thus, in the l.p. position of the switch, the filter will pass all frequencies from zero up to the cut-off frequency which can be set within the range 20 c/s-20 kc/s. The h.p. filter has the inverse characteristic of the l.p. section and, consequently, if the two units are connected in cascade, a bandpass filter having both adjustable bandwidth and centre frequency is obtained.

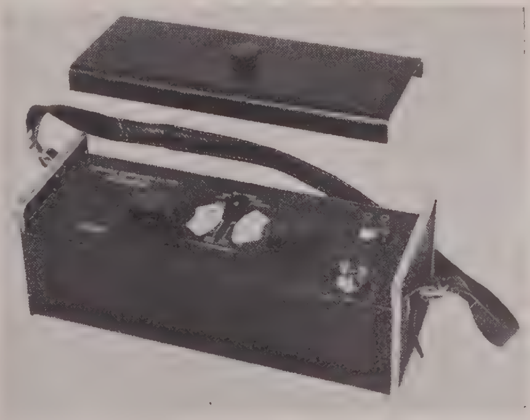


Fig. 4.—Variable bandwidth filter shown by Dawe Instruments, Ltd.

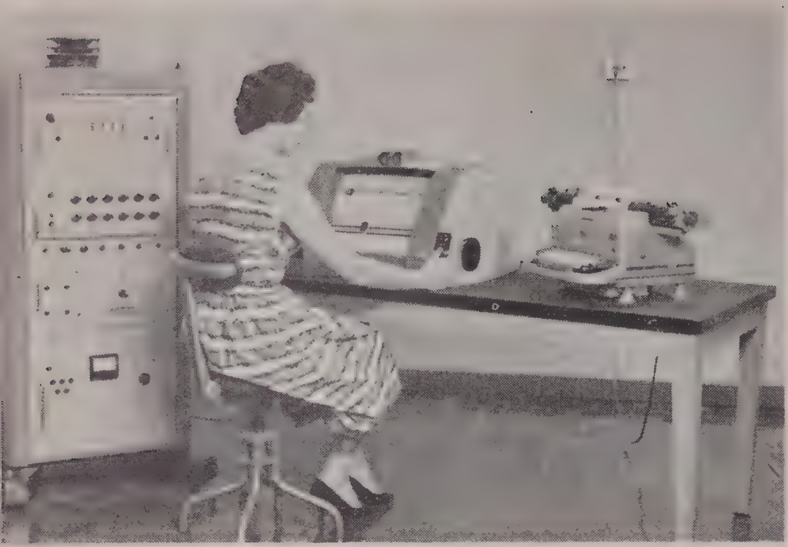


Fig. 5.—Type TRE12 trace reading equipment shown by Southern Instruments, Ltd.

The input and output impedances of the instrument are both 600 ohms, and the insertion loss varies from zero within the passband up to 3 dB at the cut-off frequencies. The attenuation beyond cut-off is greater than 20 dB per octave at both the low- and high-frequency ends of the range. The filter is a passive network, and consequently no power supplies or batteries are required.

Chart Analysis

Pen recorders are frequently used for a wide variety of purposes, and a large number of manufacturers now produce recorders either of the moving-coil type, in which the pen traces a circular arc on the chart, or the self-balancing potentiometer type which is generally arranged to trace a straight line when deflected. In many applications of recorders, however, the shape of the co-ordinate system is of minor importance because the instruments are used purely for control or monitoring purposes so that it is merely necessary to examine a length of recorder chart and check that the trace is confined to a specified part of the instrument range. For example, with a recorder used for temperature measurement, it may be necessary only to ensure that the temperature indicated did not fall below some specified value during the time taken to perform a particular process, in which case it is unnecessary to examine the chart in detail.

When it is necessary to analyse a recorder chart, however, to determine, say, the mean value of the quantity under observation, the task can be both time-consuming and laborious. Much of the effort in evaluating recorder charts is saved by means of the TRE12 trace reading equipment produced by Southern Instruments, Ltd. (Fig. 5). The chart to be analysed is mounted on a drive mechanism, and the appropriate calibration curve is drawn on the surface of a cylinder which is mounted immediately below the chart. The cylinder which carries the calibration curve is coupled to a potentiometer which is supplied from a d.c. source. Consequently, the ordinate of a particular point on the chart may be "read" or converted into a d.c. voltage simply by setting the cross-wires of a cursor over the point on the chart, and then rotating the calibration cylinder until the calibration curve passes through the cross-wires of a second cursor. The voltage picked off from the potentiometer is then proportional to the magnitude of the ordinate of the point on the chart in terms of the chart calibration. By pressing a button, the potentiometer voltage may be read out from the trace reader and, by comparison with a reference potential, converted into a decimal digital form which is displayed on a gas tube indicator together with its sign and any scale factor which has to be applied. The output may also be obtained by means of a punched card, perforated paper tape, printed by an electric typewriter or any combination of these methods, and thus the outputs are in a form which can be accepted by a computer.

The instrument is designed to deal with up to twelve independent channels or traces on one chart which may be up to 12in wide and 200ft long. Each trace can, of course, have its own individual calibration curve and scale factor. When the output of a particular point on one channel has been digitised, the reader automatically switches to the next channel so that the corresponding point on this curve may be digitised. To avoid confusion, the particular channel in use is indicated by a display at the top of the reader cabinet.

Components

As a result of the increasing uses of printed circuits and transistors, the demand for reliable miniature components continues to grow. Thus, A. H. Hunt (Capacitors), Ltd., have introduced a series of tantalum foil electrolytic capacitors 14·5 mm long by 3·5 mm in diameter, in which the capacitance and working voltage are within the range 12 μF at 3 V and 1·5 μF at 25 V. The units are designed to operate at from −30°C to +85°C.

Miniature wire-wound resistors are now manufactured by several firms to tolerances which approach those of sub-standard resistors. For example, the McMurdo Instrument Co. displayed wire-wound resistors ranging in values from 0·1 ohm to 10 megohms with tolerances as close as ±0·02 per cent. The dissipation of these resistors varies from 0·2 to 2 W.

The miniaturisation of variable resistors or potentiometers presents a number of problems associated with mounting. Miniature Electronic Components, Ltd.,

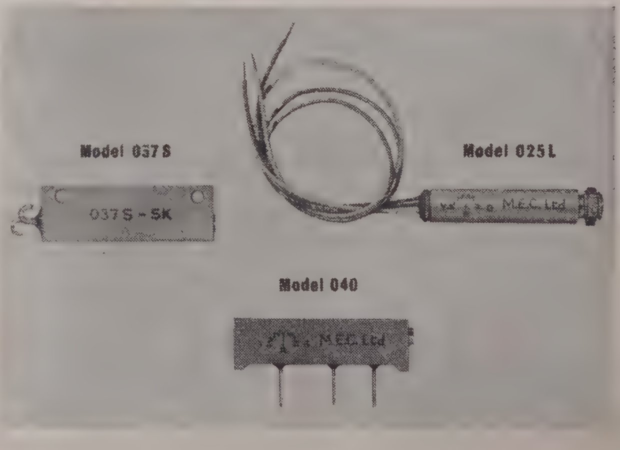


Fig. 6.—Miniature Electronic Components, Ltd., range of small potentiometers

showed a range of small potentiometers arranged for three standard types of mounting, e.g. mounting behind a panel, screwing into a panel or on to a printed circuit board. In spite of their small size, these units have a power rating of 2·75 W at 50°C (Fig. 6).

The Bristol Aircraft Co. have produced a new type of valve clip, to be manufactured by the Haven Engineering Co., which is intended to be used with an open box chassis. The main advantage of the clip is that it completely surrounds and supports the valve by means of six separate fingers which are in intimate contact with both the envelope and the chassis. The envelope is therefore efficiently cooled by conduction to the chassis, the temperature rise being only 3°C per watt dissipated. Efficient cooling of the envelope should greatly reduce the probability of valve failure. A secondary advantage of the clip is that the valve is secured to the chassis merely by two small screws, and consequently the cost of punching the chassis is reduced.

Direct Current Sources

The increasing uses of transistors in electronic circuits has resulted in the production of a variety of mains-operated stabilised power units capable of delivering d.c. at the low voltages suitable for operating transistor circuits. Thus, the type TA40 power supply, produced by Venner Electronics, Ltd., is designed to provide a maximum current of 0·3 A at any voltage within the range 0·5-50 V. The stabiliser, which is of the series type, employs zener diodes to generate the reference potential, and the loop gain of the system is sufficiently high to reduce the effective output impedance of the unit to less than 1 ohm and the output ripple voltage to 1 mV.

The low voltages demanded by transistor circuits make it practical to employ miniature accumulators for operating portable measuring instruments. The hermetically-sealed nickel cadmium storage cells manufactured by D.E.A.C. (Great Britain), Ltd., are eminently suitable for this purpose for, being sealed in nickelled steel containers, they are both robust and of low weight and can also be mounted in any position. In addition, the cells have the advantage of extremely good shelf life and they produce no fumes. The cells, which are made in sizes varying from 20 mAh to 23 Ah, have an average operating voltage of 1·22 V which falls slowly to 1·1 V when the cell is nearly discharged, after which the voltage falls rapidly.

Electronic Equipment Design Trends

By I. G. CRESSELL, B.Sc., A.Inst.P., A.M.I.E.E.*

THE 1960 International Instruments, Electronics and Automation Exhibition showed the all-pervading influence of electronics in every field of industrial activity. The pressure of military electronic development, consequent upon the needs for the detection, tracking, and data handling of missiles, provides inducement for the steady introduction of more reliable, more compact and more complex circuitry. The civil demand, with its healthy cost disciplines and requirements of simpler maintenance, acts as a stimulus to the design of simpler and cheaper aids which, freed from the tight military specifications by less rigorous environmental conditions, may well diverge rapidly from their military parents.

The year 1960 is notable for the impact of transistors and other semiconducting devices on electronic design. An estimated output of 65 million units, worth £70 million, indicates that the transistor industry is now a significant force. When linked with printed circuit techniques and a steady improvement in frequency performance, there are few applications of electronics in which these newer circuit elements will not play some part. The bulk application of transistors supplements, rather than competes with, the use of conventional thermionic valves, which are themselves developing in the direction of smaller size, increased ruggedness and reliability. It is also evident that printed circuit techniques, which were believed by many to be economic only for large production batches, are in fact applicable, with substantial savings in assembly time, to small-scale specialised equipment.

The Exhibition poses many questions to both the specialist and the non-specialist engineer. In the presence of what amounts to an electronic revolution, it must be considered whether one can measure, control, or record in some more efficient manner than was previously technically possible or feasible on a cost basis.

In reviewing the Exhibition a selective approach must be adopted and only the more important topics of general interest can be covered adequately, since the author concluded sadly, that with three thousand exhibits on a single stand, his data-handling and storage capacity was overloaded.

Stereoscopic Television

In industrial handling problems, using remote control by television, the capability of depth judgment is often important. This facility, which the human operator enjoys by natural stereoscopic vision, may be simulated electronically by duplication of television camera facilities, using a camera spacing equivalent to that of the human eyes, with dual display and an appropriate viewer. Such a method is extremely wasteful, and in the system offered

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* Marconi's Wireless Telegraph Co., Ltd.

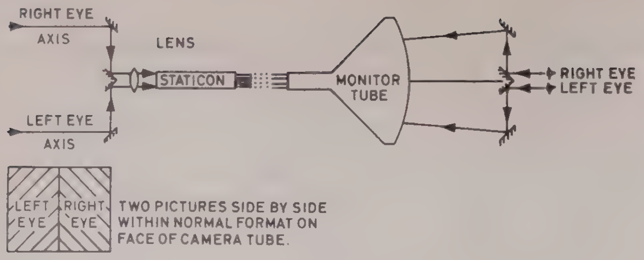


Fig. 1.—Diagrammatic illustration of Pye stereoscopic television system

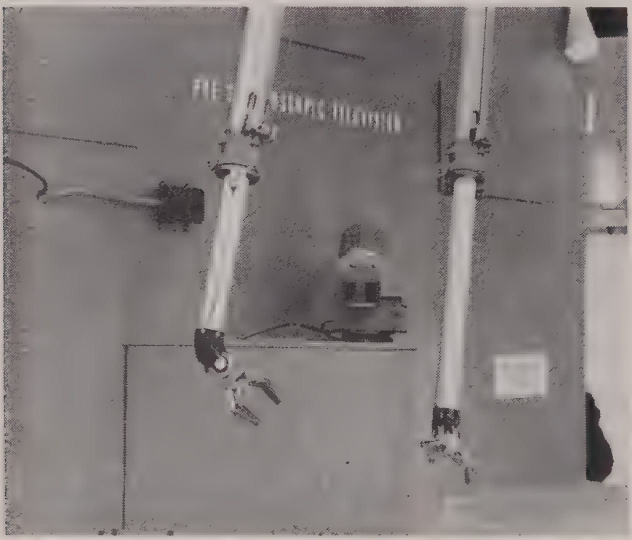


Fig. 2.—Pye industrial television camera with three-dimensional attachment as demonstrated at the exhibition in conjunction with a remote handling system

by Pye the stereoscopic effect is obtained by a mirror beam splitting system at a single camera position, with a further series of mirrors at the single monitor position. The latter provide the eyes with relevant picture information as though the eyes were actually at the camera positions. Fig. 1 shows the system diagrammatically and a standard industrial camera fitted with the stereoscopic attachment is illustrated in Fig. 2.

It is claimed that increased effective depth of focus is obtained with the system, which can be of importance in a stereoscopic system, since the eye cannot tolerate out-of-focus information in a 3-D picture. Further, the system may be readily added to an existing monocular installation consisting of standard equipment.

Semiconductors

The range of semiconductor devices shows no signs of slowing down its rate of product development. The large amount of electronic equipment, fully transistorised, displayed at the Exhibition demonstrated that production capacity for the more advanced types is now available.

One of the leaders in the field of economically-priced transistors is Mullard, Ltd., whose semiconductor exhibit typified the progress made in recent years. The alloy-diffusion process used successfully in the OC170 series of transistors has been extended to a range of v.h.f. transistor fabrication; the AFZ11 will give 10 dB power gain at 100 Mc/s, with a noise figure of 6 dB and a current gain of 50. A further development type is demonstrated in a v.h.f. communications receiver for the 174 Mc/s band. The transistor used is capable of 10 dB power gain at 200 Mc/s, with a noise figure less than 9 dB. Such devices are indicative of the freedom from frequency response restrictions which is now available to the circuit designer.

A relative newcomer to the semiconductor device family is the p-n-p-n four-layer structure. It may be used in flip-flop astable and monostable circuits to replace two conventional transistors, or as a speech path in an automatic telephone circuit. The production version, the ATZ10, was demonstrated by Mullard as a decade ring counter, at counting speeds of 30 kc/s. It has an off-on impedance ratio greater than 3 million to 1.

Fast switching to 50 mA, with a rise time of one millimicrosecond, is possible using avalanche transistors. In an interesting demonstration, such pulses were displayed at a pulse repetition frequency of 4 Mc/s, on a sampling oscilloscope which itself uses an avalanche transistor in the sampling circuit. Among the other Mullard exhibits the ORP60 miniature cadmium sulphide photocell was noteworthy. Designed to drive a cold-cathode trigger tube, its small photo-sensitive area of only 0·25 sq mm makes it especially suitable for positional control purposes.

A newcomer to the British scene, the International Rectifier Co. (Great Britain), Ltd., showed silicon photovoltaic read-out matrices. These elements have a fast response time of the order of 10 μsec, and are intended for use in the detection of light passing through punched card or tape. Typical figures quoted are 300 μA at 1,000 foot-candle illumination, for an element area of 0·01 sq in. The units can be supplied in single or multiple assemblies (Fig. 3). Of interest to the power engineer are the series of Thyrode silicon-controlled rectifiers. These are a derivative of the p-n-p-n family of devices, and are suitable for static switching, d.c. motor control, ignition firing and similar duties. They are capable, in the X16RCZ-20 series, of controlling up to 16 A. These remarkable devices, which are three-terminal, have an overall height of 1·615in.

The Westinghouse Brake & Signal Co. also displayed silicon-controlled rectifiers under the trade name "Trinistor." It is noteworthy that semiconductors are steadily making ground in the medium-power range of control equipment, and the company's exhibit was designed to illustrate this point, two "Trinistors" being connected in a 13 kVA regulator circuit, with a tungsten lamp load totalling 10 kW. In conjunction with silicon rectifiers, "Trinistors" were shown as a 5 kW controllable rectifier

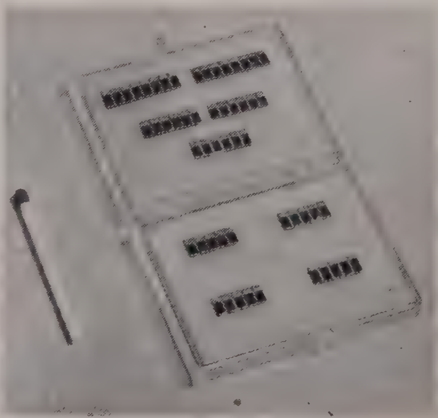


Fig. 3.—International Rectifier Corporation silicon photovoltaic read-out matrices

set, delivering 25 A at up to 200 V at 30°C. A widespread use for the device is expected in the fluorescent lighting field. Two " Trinistors " were shown supplying 1 kW at 240 V, 1,000 c/s to a bank of twelve 80 W fluorescent tubes from a nominal 24 V d.c. input. A full load efficiency of 85 per cent is obtained and a 5 per cent load regulation from open circuit to full load.

Data Recording

The international character of the Exhibition was illustrated by the products of the Ampex Corporation, of California. This company is already well known in this country for its video-tape system, extensively used for television recording. The AR-200 recorder has an overall weight of 90 lb, a volume of 1·6 cu ft, a tape length of 2,500ft, and seven to thirty-two track recordings. Modular design permits recording methods to be changed merely by withdrawing one amplifier and plugging in another. Solid state components and printed circuits are used throughout. Frequency response is from 50 to 100,000 c/s at 60in/sec tape speed. The FR-100B recorder for ground use has a photo-conductor/transistor assembly for servo-controlled tape tension.

Computers

There are now nine major companies engaged in digital computer production, and a considerably larger number manufacturing analogue types. The Ferranti " Sirius " is a small high-speed desk-size machine. A set of 27 simultaneous equations can be solved in six minutes. Storage is provided for 1,000 words by delay lines, with additional storage capacity for a maximum of 10,000 words. Input is by paper tape reader, output by " Teletype " punch. The " Argus " is a transistorised machine with a ferrite core memory of 1,024 words capacity. It has been designed for control of industrial processes requiring many parallel input and output channels to the computer.

The English Electric Co. exhibited their new " Datapacs," i.e. basic logic elements for electronic data-logging and processing systems. These standard 4½in by 6½in units are fully transistorised printed circuit packages and are linked by a multi-point scanning equipment. The scanner, complete with analogue/digital conversion, amplifiers, filters and print-out mechanism, is to be supplied to the Atomic Energy Authority, Risley.

The E.M.I. Co. displayed the analogue EMIAC II computer, showing an industrial application. Some of the precision ancillary equipment associated with the EMIDEC computers was also shown. The high-speed cheque sorter, known as " Fred " (figure reading electronic device), was also on display.

De Havilland Propellers have produced a new analogue computer, "Anatrol," for use as an on-line system (Fig. 4). It is claimed that it represents a new approach to design, and leads to a low level of complexity and cost. The minimum of computing amplifiers and multipliers are formed into an arithmetic unit. This unit is used for step-by-step solution of the equations according to a pre-selected programme. Short information stores are used between steps, and long stores are used to clamp the output at the last computed figure whilst fresh values are computed. Twenty-five steps are available, and the "Anatrol" is equivalent to a machine employing 75 computing amplifiers and 25 multipliers. The computer uses semiconductor devices exclusively, except for certain electro-mechanical switching elements. Module construction permits different component-unit combinations, according to the problem in hand.

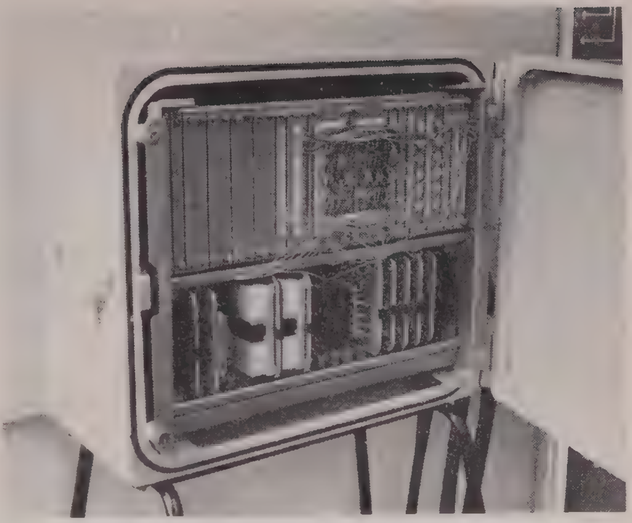


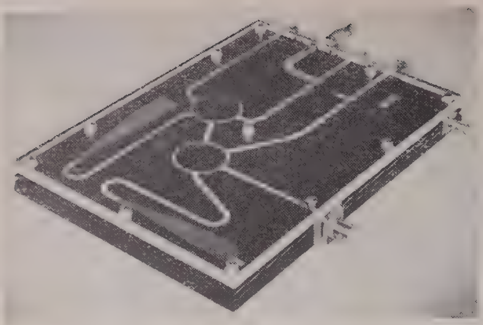
Fig. 4.—" Anatrol " on-line process control computer. (de Havilland Propellers, Ltd.)

The A.E.I. group exhibited the 955 analogue computer which solves linear and non-linear differential equations. The simulation of a system with the analogue computer permits a study of its dynamic performance and the optimisation of its parameters is possible without lengthy experimental work. The computer offers facilities for setting up linear and non-linear functions using standard size units, and the layout of the computer may be arranged to suit any particular problem by " patch-cords " across the front of the instrument. Scale models of the A.E.I. 1010 data processing system were shown and it is claimed that this type of computer is four times as fast, and can control twice as much peripheral equipment as any other British computer in the same price range.

Micro-Miniaturisation

The circuit trend in modern computing systems is towards a multiplicity of standardised logic elements, with a high degree of standardisation of components. It is evident from the computers displayed at the Exhibition that printed circuits and transistors, whilst providing considerable economies in space factor over thermionic valve assemblies have, by their very ease of application, encouraged the design of computing systems which are very large and in some cases, elephantine. Where large computers demand special environmental conditions, the cost of the building required to house them may be a substantial fraction of the total cost to the user. This situation is unlikely to be solved by further miniaturisation as such, and what is required is a solution to the problem which will reduce bulk by at least one order of magnitude in standardised units, whilst retaining enough design flexibility to permit large-scale manufacturing runs of the component units without excessive re-tooling costs.

A number of approaches have been tried, on both sides of the Atlantic, to the technique of micro-miniaturisation, of which the micro-module units exhibited by R.C.A. (Great Britain) are an excellent example. These units



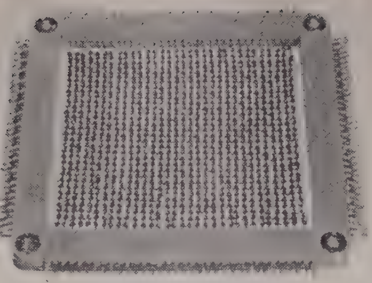


Fig. 5 (left).—Cossor Radar & Electronics S-band balanced mixing head for M.T.I. receiver strip-line construction

Fig. 6 (right).—Memory plane built up of Ferramic square loop cores. (Plessey Co., Ltd.)

are the fruits of a programme started in 1956 and sponsored by the U.S. Signal Corps since 1958. A packaging goal of several hundred thousand parts per cubic foot is aimed at. The micro-modules are of 0·350in standard dimension, and are stacked vertically, with twelve peripheral connections running as miniature busbars between modules. Resistors, capacitors and inductors are produced by standard techniques of deposition, and diodes and transistors can be incorporated in the modules. A wide variety of circuit configuration has proved possible.

The general acceptance of such a system will depend on two factors. The first is the willingness of design engineers to standardise their requirements to basically conform to the system potentialities. The second factor is the ability of the micro-module system to satisfy the detail requirements of "custom-built" electronics. These two factors are not necessarily in conflict, as has been shown in printed circuit work. It remains to be seen whether the reliability which is inherently possible in micro-modules is, in fact, sufficient to allow "throw-away" maintenance, and the economics for civil use have yet to be demonstrated.

A more specialised approach to the problem is the integration of the semiconductor device with the associated circuit elements. Such integrated units are becoming known as "solid circuit" semiconductor networks and were exhibited in one form by Texas Instruments, Ltd., permitting a condensation factor of a hundred-to-one over normal miniaturisation techniques. In a demonstrated adder of this type, Texas have succeeded in employing: (i) An invertor, consisting of a common emitter amplifier, a diode, and resistances. (i) Diode gates performing "and/or" operations, with resistors. (ii) A bistable circuit or flip-flop, used to delay the carry digit. This package contains transistors, diodes, resistors and capacitors. (iv) A diode gating unit to provide correct drive for the bistable circuit.

A programme at the Royal Radar Establishment has been in operation along similar lines to the R.C.A. micro-module approach, with the object of a compression factor of 10 : 1, and increased reliability. This display formed an interesting "state-of-the-art" exhibit. Resistors of nickel chromium film, 75 Angströms thick, are processed to give up to 100,000 ohms in an area 5 mm square. Capacitors are made with magnesium fluoride dielectric giving 2,000 pF at 25 V d.c. for the same area.

Strip-Line Techniques

The strip-line technique in microwave assemblies offers some hope of escape from ever-increasing complexity of the "plumbing" in certain applications, and the exhibit of Cossor Radar & Electronics, Ltd., is a good demonstration of feasibility in both S and X band application. Fig. 5 shows an S-band mixing head for use in an M.T.I. receiver. Performance achieved in hybrid rings is such that equality of power split between coupled arms is better than ± 5 dB over 25 per cent bandwidth. A CV.124 detector is edge mounted and easily replaceable. A micrometer head mounted in a $\lambda/2$ cavity section enables end loading to provide a reaction wavemeter, edge coupled to the STALO (stabilised local oscillator) feed line.

The Exhibition as a whole was a stimulating, if exhausting, experience, as a study of the catalogue would indicate. It showed that the rate of change of the electronics industry was well maintained, and augured well for our competitive position in the export field.

Electricity Supply Conference

THE customary conference of electricity supply industry delegates attending the British Electrical Power Convention was held in the Odeon Cinema, Bournemouth, on Monday last. The Conference, presided over by Mr. C. R. King, chairman of the Electricity Council, was an informal gathering providing a private forum for discussing some aspects of development in the supply industry.

The first subject, "The Administrative and Technical Problems of Running One of the Generating Board Divisions," was introduced by Mr. W. H. Dunkley, controller, South Eastern Division, Central Electricity Generating Board. Two distribution problems were then dealt with independently, "The Problem of Reinforcement," by Mr. H. W. Taylor, chief engineer, Southern Electricity Board, and "Public Relations," by Mr. N. H. Bridge, assistant chief commercial officer, North Western Board. Various speakers discussed the themes and two Electricity Consultative Council chairmen—Alderman Sir Isaac Hayward and Alderman Cdr. D. S. E. Thompson—also spoke.

This year the set speeches were briefer, giving more time for contributions from the "floor," so that a general discussion was able to develop.

In addition to a large attendance of representatives of the Electricity Council, the C.E.G.B., and the twelve Area Boards, representatives from the Consultative Councils, the supply industry in Scotland, the Ministry of Power, and various staff association committees were present by special invitation.

Automatic Control

By G. B. MARSON, B.Sc., A.Inst.P.*

THE overall picture of the automatic control field gained from this year's I.E.A. Exhibition is one of increasingly complex systems whose component units, however, are becoming smaller, simpler, and probably more reliable. The impressive displays of several of the larger firms indicate that the optimising or peak-seeking type of control system may be applied to industrial plants in this country in the foreseeable future. Conventional process control schemes were operated almost exclusively by analogue equipment, but with provision for digital data logging and executive monitoring of many process variables. In process control instruments, the accent was on miniature electronic units, standardised to a large extent as regards size, but not in respect of electrical operating characteristics. The number of miniature ranges available had about doubled since the last Exhibition, due mainly to the influx of American and Continental products. A large number of new actuators for operating final control elements was seen and at least one of these was based on an entirely new principle of operation. Many of the others are now operated by hydraulic means, due no doubt to the long experience of the aircraft industry in this medium.

Control Systems

Present-day process control systems consist generally of a number of separate control loops, each loop attempting to maintain some physical quantity within the plant at a predetermined value. These control values are arrived at as a result of the calculations by, and experience of, the plant designer and may often be modified after some operating experience to gain higher overall efficiency or a better end product. Visitors to this year's Exhibition were introduced to a new concept known as the optimising or peak-seeking control system. In this system a computer continuously alters one or more of the plant variables by small increments and notes whether any improvement in overall efficiency results. In this way, the computer eventually determines automatically the optimum conditions for peak efficiency, a process which would be long and expensive by manual trial and error methods. Such a system was demonstrated on the Elliott-Automation stand by the "Optimat" control unit which controlled the operation of an oil distillation column. De Havilland Propellers showed an analogue computer especially suitable for process optimisation.

Among the conventional control schemes seen was an electronic control system for automatic blending of liquids, shown by Constructors John Brown, Ltd., and a working level and flow control system on the Bailey Meters stand (Fig. 1), using this company's new range of miniature electronic transmitters and controllers. Lancashire Dynamo Electronic Products showed a fully transistorised capacitance operated level control equipment. The Swartwout Co. presented a control scheme using miniature electronic instruments in the form of a graphic panel destined for an oil refinery in Australia. Making its first appearance in this country, on the Pullin stand, was a range of electronic control equipment by Guardigli of Milan, and the new Honeywell Brown and Foxboro miniature electronic schemes attracted much attention.

Process Control Equipment

Miniature electronic instruments dominated the ranges of process controllers shown. Several appeared for the first time in this country, and most of the rest had undergone considerable modification since the last Exhibition.

On the Foxboro-Yoxall stand the comprehensive range of electronic "Consotrol" instruments showed great flexibility in possible panel arrangements. This system allows set point, manual station, controller and recorder to be mounted either together or in separate places, allowing each function to occupy its proper position in the control scheme. Similar attention to varied presentation requirements was noted in the new Fielden electronic control equipment.

Two types of controller are included in the Foxboro range—a universal three-term controller with a wide range of settings, and a simpler magnetic amplifier flow controller with control actions fixed at optimum values. Evershed's new Mark 4 controller has been transistorised and combined with a minature recorder which provides a 4in chart display and control setting knobs in a 6in square

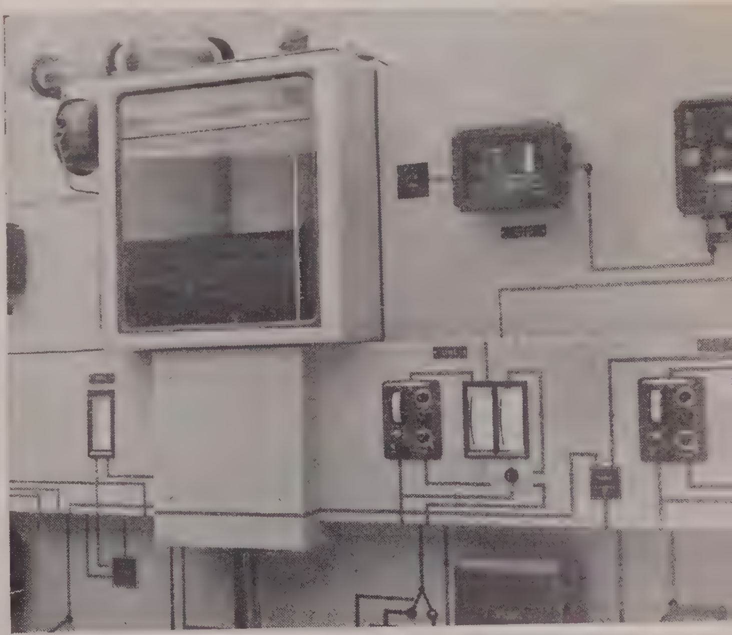


Fig. 1.—Part of the Bailey Meters & Controls, Ltd., display showing their level and flow control system

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* George Kent, Ltd.

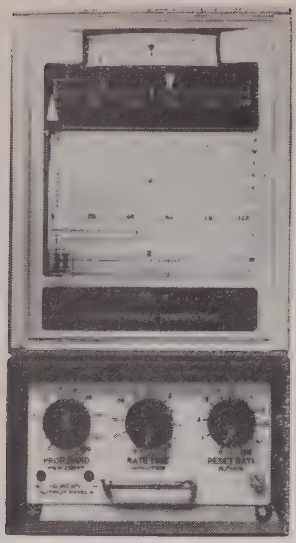


Fig. 2.—Miniature electronic recorder-controller shown by Honeywell

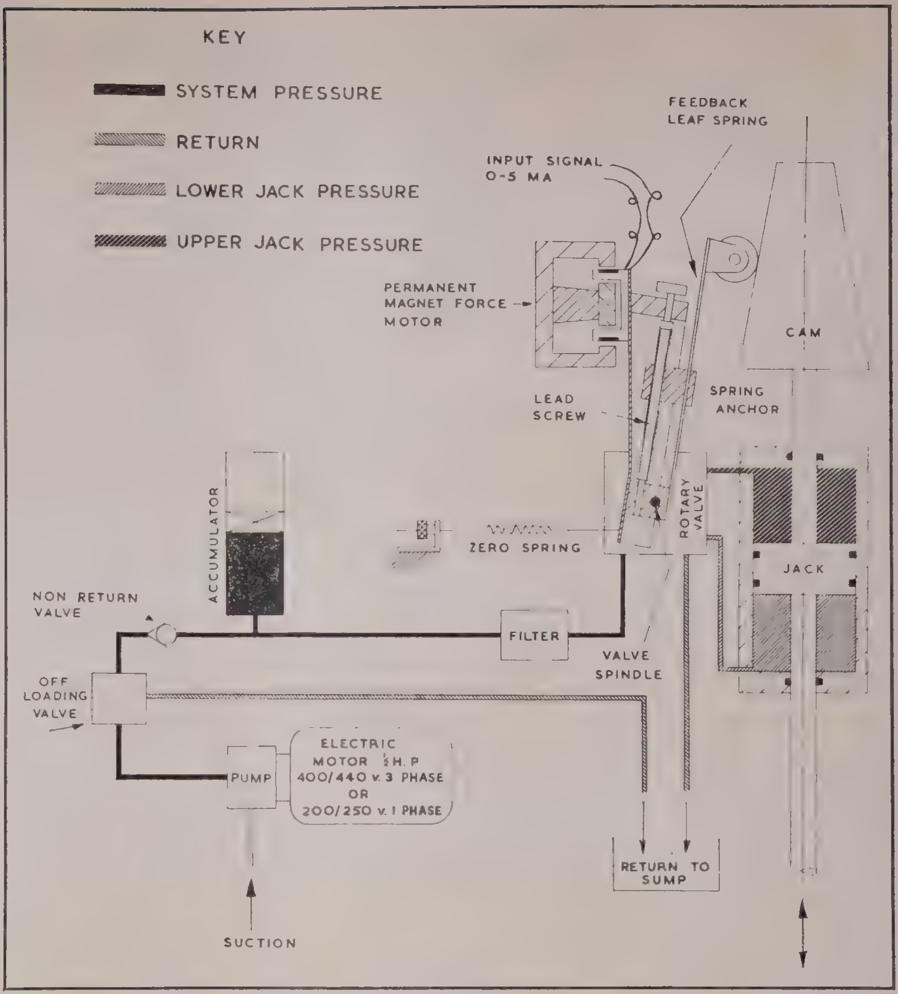


Fig. 3.—Diagram showing the position feedback system used in the Wilmot-Breeden electro-hydraulic actuator

panel space. Both Honeywell Brown and Swartwout showed combined controller-recorders, the Honeywell "Tel-o-set" instrument following this firm's previous fashion in having the control unit attached directly beneath the recorder (Fig. 2).

All the above-mentioned controllers transmit a d.c. output signal, but it was noticed that there is still no standardisation of either the range or zero of telemetry signals. Thus Dewrance Microsen, Swartwout, and Pullin use 1 to 5 mA, Honeywell Brown 4 to 20 mA, Evershed and Fielden 0 to 15 mA, Bailey and Kent 0 to 10 mA and Foxboro 10 to 50 mA. This confusion, together with the 115 V supply requirement of the American-designed instruments, is likely to handicap severely the freedom of system designers, and it is to be hoped that some semblance of order will have appeared before the next Exhibition.

Among the many pneumatic controllers seen was the Francel "Stabilac" unit, appearing for the first time on the stand of Hunt & Mitton, Ltd. All the major components of this instrument are of the plug-in type and can be removed without affecting the ability of the controller to operate with such components as remain. George Kent, Ltd., showed a range of pneumatic controllers appearing for the first time in conjunction with their Mark 3 electronic recorder; and also a time proportioning device which allows pneumatic proportional or multiterm control using only an on-off regulator.

Particularly applicable to temperature control was the Cambridge Instrument Co.'s multi-point electronic recorder-controller which uses a cam operated system allowing independent setting of up to six control points on a single instrument. The Foster Instrument Co. showed indicating temperature controllers suitable for stepped and saturable reactor control, and an inexpensive non-indicating controller incorporating a control error meter. Sifam Electrical Instruments also presented indicator-controllers, providing both on-off and time-proportioning actions. An ingenious method of avoiding the loading of control contacts was seen in the new Metrix controller which uses an aluminium vane as the measuring pointer to provide damping of a h.f. oscillator coil and so operate a relay. This instrument also has an elementary form of phase advance to reduce the temperature cycling associated with the on-off control of plants containing a thermal lag.

Regulating Units

One of the most important elements in a process control system is the final regulating device, which may have to produce a thrust of several tons yet respond immediately to the controller output signals. Compressed air, with its great potentiality for energy storage, has been used for many years as a medium for operating such regulators. The increased use of electronic control, however, is leading to the replacement of many pneumatically operated regulators by self-contained electro-hydraulic devices, thus avoiding the necessity for a compressed air supply to all parts of the plant.

Exhibitors showing electro-hydraulic positioners included Armstrong-Whitworth, Boulton & Paul, Normalair, the Société d'Applications des Machines Mortices, and Wilmot-Breeden. The interest of the aircraft industry here provides a refreshing example of the interchange of ideas between different control fields. One of the problems in the design of such positioners is to provide a reliable position feedback signal with which to compare the electrical input. Several methods of doing this were shown. In the new Wilmot-Breeden actuator, for example, the displacement of the regulator is communicated to a leaf spring which applies a proportionate force to the coil of an electric force motor (Fig. 3). This coil is energised by the electrical input signal and if the spring and motor forces are not exactly equal and opposite, a rotary valve is operated in the correct direction to drive the actuator to balance.

In addition to these hydraulic units, a number of firms showed pneumatic and all-electric actuators, typical of these being the new Evershed & Vignoles electric positioner, which has a thrust of up to 500 lb and a stroke of 2in and is controlled by a transistorised feedback amplifier.

A new and ingenious method of regulator operation was seen in the Swartwout "Thermo Drive" actuator. In this device, a volatile liquid is evaporated in an insulated container by an electric heater. A small valve controls the release of the vapour, which is condensed on a cooled surface and returned to the bottom of the insulated container. As the release valve is closed pressure builds up in the container and forces down a diaphragm connected to the unit to be actuated. Positioning, as on the Wilmot-Breeden actuator, is accomplished via an electric force motor and spring.

Motor, Machine and Material Control

For electric motors of around 1 h.p., control units using silicon controlled rectifiers were shown on the Lancashire Dynamo, A.E.I., Brush, and Westinghouse stands. A new speed corrector unit was shown by Allspeeds, Ltd., for use with their Kopp variable speed gears, Fig. 4. This device will automatically adjust one of two speeds whose ratio is not known, to maintain the other speed constant. The necessity for this arises, for example, in winding machinery where the drum speed may have to be varied widely to maintain a constant cable speed. An accurate "Velodyne" speed control system was shown by Servomex Controls, Ltd., providing a speed range of ±7,500 r.p.m. with a power output of up to 0·5 b.h.p. and a stability of ±2 r.p.m. per hour.

Machine tool control is a fast-growing field lending itself particularly to the application of digital methods. Among exhibitors of this type of equipment were Teledictor, who showed a low-cost drill positioning machine operated either manually or from punched-card equipment, Ekco Electronics, Plessey and Airmec (Fig. 5). The last firm illustrated a punched-tape system for tool control in three dimensions. The G.E.C. Electronics Division showed sequence control equipment for operating an injection moulding machine, which can deal with a large number of successive and simultaneous operations.

The products created by such automatic methods might well be examined by the Ferranti co-ordinate inspection machine, which uses a probe to find the co-ordinates of any desired point on an article. The position of the probe in two dimensions is measured to an accuracy of 0·001in by a moiré fringe technique.

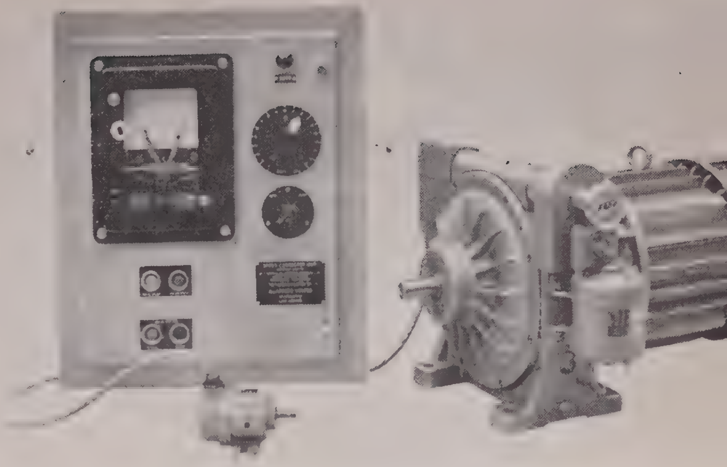


Fig. 4.—Allspeeds new corrector unit for use with their Kopp variable speed gears

Control of different types of machine was seen in the Ericsson Telephones steriliser controller type 194 and knitting machine controller type 309B. The former instrument controls three four-stage sterilising processes by pushbutton selection, and the latter enables an industrial knitting machine to be set up and controlled by punched cards, more than doubling the maximum knitting speed as compared with manual operation.

Numerous examples were seen of this type of cooperation between electronics firms and the chemical, textile, and other industries. There is still an enormous gap, however, between the more advanced possibilities of electronic control and their practical and economic application throughout industry. One of the greatest stumbling blocks in the past has been the difficulty of promulgating new ideas among engineers of widely differing interests. It is to be hoped that the almost bewildering complexity of this latest exhibition will not obscure this primary purpose.

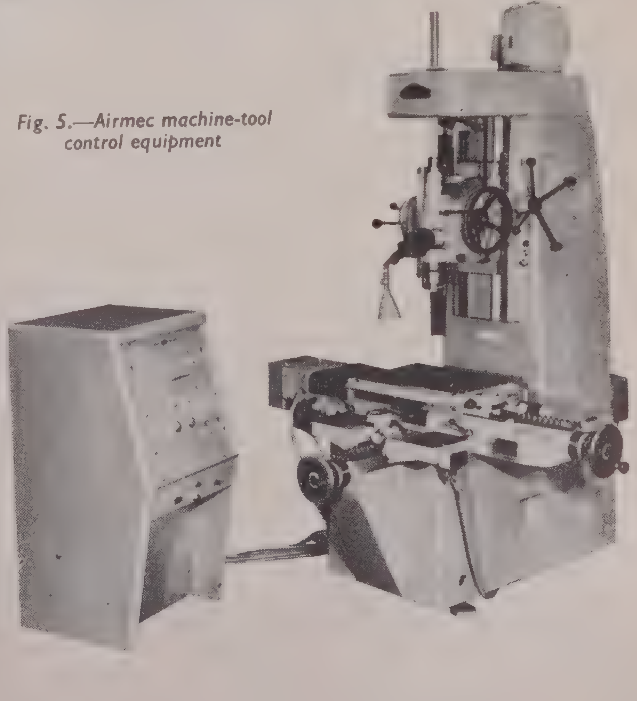


Fig. 5.—Airmec machine-tool control equipment

Action Against E.T.U. Officials

LAST week in the High Court of Justice Mr. Justice Danckwerts heard a motion on behalf of Mr. Frank Joseph Chapple, a member of the Electrical Trades Union, in an action brought by him against Mr. Frank Foulkes, general president of the E.T.U., Mr. Frank Haxell, general secretary, and Mr. Robert G. McLennan, assistant general secretary. Mr. Chapple asked for an interim injunction restraining the respondents until the trial of the action from proceeding with an election for the position of assistant general secretary until they had circulated to members of the union a statement prepared by him and submitted to the E.T.U. Executive Council, or restraining them from issuing the statement in altered form.

Mr. W. Wells, Q.C., counsel for the plaintiff, said that the statement in question had been edited by the respondents in such a way that it would not present the objects for which he stood and would harm him in the eyes of his fellow members. As he was unable to obtain satisfactory assurances from the respondents, Mr. Chapple issued a writ claiming that the union's rules required the Council to print and circulate his statement and that a decision to print and circulate the statement in altered form was *ultra vires* or in breach of the rules; he also asked for an injunction. Mr. Wells then read the plaintiff's address, drawing attention to passages deleted or altered; these were generally critical of the principal officers of the union. In an affidavit Mr. Chapple alleged that the defendants were Communists who frequently used their positions to further Communist doctrines for their own ends.

Mr. D. N. Pritt, Q.C., for the respondents, presented a statement by Mr. Haxell to the effect that consideration of Mr. Chapple's request for the suspension of the election had been deferred for the taking of legal advice but before this was received Mr. Chapple's writ was issued. The Executive Council, after considering legal opinion, decided that they had no power to suspend the election and suspension would upset the "timetable" under the rules. Mr. Haxell maintained that the altered version of Mr. Chapple's statement was likely to do the plaintiff less harm than the original form. He further asserted that the respondents' political views did not affect the issues raised.

Mr. Wells said it appeared that the Executive Council claimed that it had power to interpret the rules and that Mr. Chapple had no right to approach the Court for the determination of his rights. He (counsel) submitted that the Court could interpret the rules of trade unions and other organisations.

At the close of the second day's proceedings Mr. Justice Danckwerts granted the interim injunction asked for and directed that the costs of the application should be costs in the action.

Mr. Pritt had said that the printing of the address was proceeding when notice of the application was received. The defendants thought that their proper course was to let the printing of the 230,000 copies proceed. If the Court were to order Mr. Chapple's statement to be separately printed and distributed in its original form it could be done at a cost of about £5,000. Nobody could ask the union to risk so many causes of action by distributing a libellous document although the plaintiff thought that it would be privileged.

In giving his decision the Judge said that the power given to the Executive Council to interpret rules or decide upon matters outside them did not oust the jurisdiction of the Court to decide on such matters and give relief.

The rule in question stipulated that the Council should print and circulate on behalf of candidates for office their statements of their industrial record and what they intended to perform on behalf of the union. He had been told that a number of passages in Mr. Chapple's statement had been deleted because they did not come within the rule.

It had been submitted for the defendants that an election statement must be subjected to limitation because it might contain seditious or slanderous matter. He found nothing seditious or slanderous in the deleted passages.

A meeting of the Executive Council was held at the weekend following which a statement was issued saying that the question of an appeal had been considered but, having regard to present circumstances and to the publicity already given to the passages deleted, a successful appeal would not materially alter the position and they would therefore not be justified in adding to the costs already incurred as a result of the litigation. While they accepted the ruling of the Court they did not agree with its interpretation of the union rules. It had been agreed that Mr. Chapple's election address should be issued as originally submitted and the election proceeded with.

HASTINGS CONFERENCE

IN his presidential address to the annual delegate conference of the Electrical Trades Union, which opened at Hastings on Monday, Mr. Frank Foulkes said that the strength of the union was demonstrated by the self-discipline of the membership and the vigilance and negotiating ability of the shop stewards. He deplored the efforts made from time to time to undermine this strength by abusing the good work carried out by shop stewards throughout industry.

On living standards, Mr. Foulkes said that during the last twelve months, although the results of national negotiations involving major claims to raise the living standards of the workers had been disappointing, the E.T.U.'s achievements in negotiations, undertaken with the minimum hardship to its members, had resulted in some individual gains of considerable magnitude for groups of workers in particular establishments and industries. He was satisfied that if the same determination had been displayed in regard to national claims, the 40-hour week and increases in wages would have been accomplished facts.

Profits and dividends continued to increase; financiers continued to make vast fortunes by speculation; and the Government's request for a general reduction in prices had met with very little response. In this atmosphere of *laissez faire,* the workers were entitled to demand and fight for their share of the increased wealth of the country. The first charge on any industry should be the living standards of those employed in the industry. The workers in nationalised industries in particular, had a right to expect that those industries should be allowed to set an example in this direction. Recent negotiations within nationalised industries had once again proved that they were completely dominated by the policies ennunciated by the Government to keep wages down to bare subsistence level, and the fear of the Boards that they might cause embarrassment to the Government and private employers if they granted wage increases. The electricity supply industry was successful in attaining a record surplus of £27 million during 1959 and made interest payments of £60 million to those who did not work in the industry; but a labourer in that industry received a net amount in wages of only £7 16s 1d a week. If he did not work but was married and had three children, he could obtain £8 3s a week in National Assistance benefit.

United Kingdom Electrical Trade in April

ELECTRICAL exports from the United Kingdom in April were valued at £21·8 million, re-exports at £313,750, and imports at £3·6 million. Compared with the first four months of 1959, exports were 5 per cent higher, re-exports 11 per cent lower and imports 33 per cent higher.

In the three months February-April, 1960, electrical exports were 2 per cent higher than in February-April last year; this compares with an increase in the previous three months, November-January, of 8 per cent over the corresponding period a year earlier. Compared with 1958-59, total exports have maintained a 12 per cent rate of increase during the past six months. Exports of "machinery other than electric" were, at £61·1 million, 20 per cent higher in February-April than a year earlier.

The largest individual market for British electrical goods in the first four months of this year was Australia, to which goods worth £7·3 million were sent compared

TABLE I.—ELECTRICAL EXPORTS

Class	Month of April 1960	Four months ended April 1959	Four months ended April 1960
	£	£	£
Generating sets:			
Diesel driven, not exceeding 10 kW	113,549	404,061	557,034
10 to 65 kW	145,412	615,748	641,837
65 to 200 kW	161,555	648,169	529,611
Over 200 kW	206,746	1,261,183	584,876
Driven by steam turbines ...	63,564	300,229	340,386
Driven by spark ignition engines, hydraulic turbines or other prime movers ...	7,944	169,720	78,547
Generators:			
Not exceeding 200 kW	141,850	408,058	440,651
Over 200 kW	236,935	384,064	545,277
Parts	1,470,904	2,375,875	3,367,120
Motors, complete, other than railway, tramway and trolley-bus:			
Not exceeding ⅛ h.p.	244,581	560,731	936,834
Over ⅛ h.p. but under 1 h.p.	58,325	180,055	244,666
1 to 250 h.p.	489,063	1,760,983	1,944,859
Exceeding 250 h.p.	306,190	748,685	902,231
Railway, tramway and trolley-bus motors, complete, and parts of all motors ...	166,142	711,059	773,994
Starting and controlling gear for electric motors	274,800	1,326,567	1,087,843
	4,087,560	11,855,187	12,975,816
Converting machinery ...	23,567	124,537	234,246
Mercury-arc rectifiers	50,247	205,082	176,989
Transformers for lighting, heating and power (including coils):			
Not exceeding 7,500 kVA	555,358	2,086,367	2,156,432
Over 7,500 kVA	383,052	1,723,268	1,209,365
Switchgear and switchboards (excl. telegraph and telephone):			
Up to 200 A and 660 V	366,970	1,342,142	1,562,913
Other	1,307,792	4,920,100	5,050,526
	2,686,986	10,401,496	10,390,471
Batteries and/or cells, primary:			
For lighting	87,349	407,851	420,721
For radio	415,761	1,407,256	1,563,524
Other	55,157	154,585	173,836
Parts (excluding carbons)	57,648	173,108	220,169
Lamps:			
Filament, exceeding 28 V	112,113	352,854	410,843
Not exceeding 28 V	32,758	127,882	128,525
Arc lamps, complete*	7,707	67,266	24,323
Discharge lamps, fluorescent tubes, etc....	99,402	384,260	343,667
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells (excl. photo-transistors), stabilising and cold cathode valves, magnetrons, klystrons	63,179	162,950	192,803
Cathode ray tubes	47,423	406,941	210,521
All other*	380,392	1,762,342	1,467,113
Parts (excluding glass bulbs)	42,195	109,698	157,724
Broadcasting and television transmitters...	95,102	434,972	212,772
Communication, navigational and radar equipment	1,919,040	6,598,608	6,277,362
Domestic receiving sets, mains	81,723	433,493	313,571
Battery (incl. complete vibrator sets) ...	106,202	230,618	354,042
Other (incl. mains/battery and car) ...	32,590	106,438	119,355
Radiograms	33,006	108,651	123,332
Television receiving sets	68,793	276,342	257,423
Public address equipment	109,984	395,268	406,417
Other radio and television apparatus, n.e.s.	98,270	264,928	509,102
Components and parts, n.e.s.	1,183,499	3,127,433	4,340,037
	4,261,398	14,418,682	14,941,574
Telegraph and telephone installations ...	638,366	2,964,887	2,431,900
Telephone instruments.	149,866	403,871	586,353
Parts	707,410	3,190,695	3,050,615
Line apparatus for long distance communication	107,192	752,021	939,326
	1,602,834	7,311,474	7,008,194
Cookers	55,627	145,660	170,224
Toasters	16,134	77,398	58,465
All other cooking appliances	34,233	129,528	169,837
Parts and accessories	93,455	325,574	372,471
Space heating appliances	22,648	86,251	104,278
Water heating appliances	30,896	118,710	121,977
Other heating appliances	20,419	102,173	94,638
Parts and accessories	78,928	295,727	362,782
Irons	62,406	255,944	288,078
Arc-welding equipment, a.c.	38,981	173,907	190,407
D.c.	57,260	233,048	236,113
Resistance welding	29,836	161,626	152,159
Electric furnace plant	128,951	380,102	355,735
Magnetos, ignition	13,480	46,314	36,256
Sparking plugs	303,456	593,400	922,488
Electric appliances, for aircraft, n.e.s. ...	392,520	1,383,189	1,344,540
For motor vehicles	635,161	1,591,152	2,602,791
For cycles	53,945	154,646	194,309
Signalling apparatus (incl. traffic signals) ...	102,105	723,082	500,495
Instruments, commercial	181,717	754,514	760,425
House service meters, incl. parts	180,832	493,873	717,272
Electro-medical apparatus (excl. deaf-aids, and X-ray)	28,607	127,805	139,920
X-ray apparatus (excl. tubes and valves) ...	39,599	148,457	195,970
Ceiling fans	108,214	344,092	362,554
Desk fans and parts of desk and ceiling fans	17,802	52,121	87,991
Vacuum cleaners	161,785	550,424	590,402
Floor polishers	66,858	294,522	305,692
Food mixers	46,653	327,952	206,797
Hair clippers and dry shavers	42,013	133,239	309,573
Other portable appliances	31,089	90,773	103,030
Parts	165,674	430,785	640,922
Portable elec. tools, incl. parts*	282,703	802,104	996,101
Telegraph and telephone cables and wires:			
Submarine	20,306	3,062,440	1,254,654
Other	377,861	1,704,071	1,860,139
Other descriptions:			
Cotton, silk or man-made fibres insulated	23,495	83,476	85,031
Enamel, glass or asbestos insulated ...	116,985	379,122	444,252
Paper insulated	545,418	2,322,281	2,547,759
Rubber insulated	226,738	1,207,140	1,089,874
Thermoplastic insulated	355,306	882,410	1,245,285
Other	224,912	687,483	849,236
	1,891,021	10,328,423	9,376,230
Accumulators for motor vehicles	130,364	578,042	512,041
For traction purposes	26,495	82,772	73,401
For radio, and other portable	36,677	100,314	117,012
All other accumulators	28,273	255,443	93,925
Parts and accessories	116,457	314,560	355,022
Electric wiring accessories	213,729	749,702	874,984
Electrical ceramic ware (incl. insulators), n.e.s.	101,561	432,863	511,207
Industrial electronic control equipment ...	184,313	424,790	615,405
Insulating cloth and tape	78,228	192,934	278,901
Other insulating materials	113,308	501,563	613,268
Permanent magnets	53,920	170,224	241,161
Radio, telegraph and telephone testing equipment, n.e.s.	192,525	527,596	645,307
Scientific electrical instruments (excl. telegraphic and telephonic; time recorders and time switches)	378,683	1,233,147	1,673,952
Electrical machinery, n.e.s.	29,284	149,477	121,259
Electrical apparatus and appliances, n.e.s....	1,158,219	3,795,751	4,126,420
TOTAL	21,763,707	78,427,594	82,525,850

* Figures for 1960 are not completely comparable with those for 1959.

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE I)

Country	Month of April 1960	Four months ended April	
		1959	1960
	£	£	£
Gibraltar	24,145	41,726	75,271
Malta and Gozo	46,638	202,427	199,081
Cyprus	112,421	244,284	327,134
Sierra Leone	29,338	140,563	157,218
Ghana	327,686	775,911	1,145,744
Nigeria	556,088	1,920,283	2,171,439
Union of South Africa	1,317,659	5,974,793	5,766,214
Rhodesia and Nyasaland	758,497	2,299,292	2,807,596
Tanganyika	46,415	159,938	221,492
Kenya	169,169	620,285	663,897
Uganda	25,984	196,440	124,876
Mauritius	85,560	215,512	250,013
Aden	67,507	251,030	240,951
Bahrain, Qatar and Trucial States ...	124,861	404,110	437,308
Kuwait	186,331	764,853	889,071
India	1,632,713	6,629,804	5,916,878
Pakistan	403,656	1,096,186	1,375,236
Singapore	204,197	1,034,191	871,479
Federation of Malaya	208,233	1,089,804	843,577
Ceylon	194,090	788,189	697,163
British North Borneo	20,784	71,118	103,356
Sarawak	20,754	81,516	76,941
Hong Kong	407,180	1,623,024	1,602,443
Australia	2,151,430	5,786,559	7,258,583
New Zealand	884,572	3,388,622	3,459,715
Fiji	31,157	139,314	76,666
Canada	1,781,658	3,688,569	4,643,566
Jamaica	208,657	560,609	676,088
Barbados	62,922	137,819	172,472
Trinidad	126,444	474,051	729,220
British Guiana	66,897	336,076	285,265
Other Commonwealth countries ...	206,745	778,256	783,645
Irish Republic	400,816	1,095,986	1,584,836
Soviet Union	118,756	377,305	624,697
Finland	219,196	373,911	697,907
Sweden	682,570	2,110,684	2,116,994
Norway	212,691	748,470	830,407
Denmark	336,248	856,958	1,226,850
Poland	61,883	164,791	321,919
Western Germany	524.746	2,197,103	1,859,621
Netherlands	562,882	2,772,297	2,224,745
Belgium	280,086	1,391,434	1,071,668
France	255,248	1,076,037	1,272,115
Switzerland...	88,102	673,578	543,287
Portugal	113,343	755,112	862,046
Spain	273,351	771,776	751,597
Italy	439,292	1,275,500	1,483,284
Austria	90,419	176,645	254,443
Yugoslavia	82,848	321,324	433,572
Greece	86,142	448,253	439,686
Turkey	92,211	325,156	347,528
Belgian Congo	60,471	164,546	215,244
Portuguese East Africa	47,902	82,652	218,554
Egypt	178,638	698,461	495,985
Libya	40,768	326,218	269,612
Morocco (excluding Tangier)	21,382	173,507	90,655
Sudan	63,507	394,764	458,954
Syria...	39,661	81,399	131,608
Lebanon	60,117	209,537	268,007
Israel	124,586	445,435	391,352
Jordan	122,516	367,961	359,735
Saudi Arabia	81,799	246,648	260,368
Iraq	289,038	1,405,062	973,938
Iran	172,259	1,351,831	920,340
Burma	57,660	377,568	192,000
Thailand	60,825	440,010	197,352
Indonesia	210,760	71,132	445,022
China	19,015	219,356	488,652
Japan	80,708	255,488	232,955
United States of America...	1,186,756	6,340,064	5,389,203
Cuba	21,063	125,414	102,741
Mexico	74,564	154,439	487,917
Colombia	29,117	92,945	183,132
Venezuela	285,460	1,488,620	1,706,471
Peru	42,707	89,268	137,028
Chile	134,265	446,726	371,935
Brazil	56,998	390,170	190,601
Uruguay	21,078	49,872	84,239
Argentine Republic	433,879	545,186	1,735,920
Other foreign countries	334,990	1,565,841	1,529,530
TOTAL	21,763,707	78,427,594	82,525,850

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of April 1960	Four months ended April	
		1959	1960
	£	£	£
Australia	34,195	153,003	121,447
Canada	113,413	287,438	449,520
Other Commonwealth countries ...	168,220	423,156	688,577
Irish Republic	114,508	311,734	416,371
Sweden	85,377	487,674	404,709
Denmark	58,115	203,762	286,760
Western Germany	621,316	2,202,667	3,073,295
Netherlands	548,975	1,893,247	2,413,911
Belgium	35,992	191,507	176,435
France	138,095	542,628	569,643
Switzerland...	109,200	458,967	578,210
Italy	77,051	335,680	501,335
United States of America...	1,289,951	3,265,699	5,462,778
Other foreign countries	196,488	875,798	820,054
TOTAL	3,590,896	11,632,960	15,963,045

with £5·8 million in the corresponding period of 1959. On the other hand, the next largest markets, India (£5·9 million), South Africa (£5·8 million) and the United States (£5·4 million), all took slightly less than in the first four months of last year. These falls were, however, offset by increases in exports to Ghana, Nigeria, Rhodesia, Pakistan, Canada, China, Venezuela and Argentina. Over £1 million worth of generating plant was shipped to Canada in April; the other principal markets this year have been the United States (£1·2 million), Australia (£1·4 million) and South Africa (£1·2 million). India (£1·2 million), South Africa (£1·2 million), Rhodesia (£838,587) and Australia (£654,581) have been the main destinations for British exports of converting machinery, rectifiers and transformers.

Radio and television apparatus worth over £1 million was shipped to both Canada and the United States during the four months ended April; other large markets were Australia (£987,676) and India (£893,090).

During the three months February-April electrical imports were 38 per cent higher than a year earlier compared with an increase of 41 per cent in the previous three months and a 1959 average of 37 per cent. Among durable consumer goods imports of refrigerators were five times the level of a year earlier.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of April 1960	Four months ended April	
		1959	1960
	£	£	£
Domestic electric washers, incorporating centrifugal water extraction	352,685	1,270,019	794,607
Other, with or without wringers ...	171,548		1,154,018
Dryers (exported as separate units) ...	12,712		149,573
Parts	98,847	318,380	394,747
Electric locomotives (incl. battery types)	299,252	1,980,674	1,200,198
Diesel locomotives with electric transmission	292,009	901,079	819,729
Welding electrodes:			
Ferrous	113,435	314,224	523,292
Non-ferrous	21,786	78,620	101,406
Electric conduit tubes and cased tubes ...	109,223	224,134	354,418
Electric carbons	102,857	386,147	419,226
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	359,102	1,124,331	1,376,848
Electric fork-lift trucks	88,784	313,946	374,196
Water and gas turbine, etc.	1,040,073	4,739,071	4,692,656
Steam turbines	482,956	1,201,090	1,914,483

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of April 1960	Four months ended April	
		1959	1960
	£	£	£
Generators, incl. parts	47,012	264,371	227,146
Motors, incl. parts	162,976	478,962	659,578
Convertors; transformers; rectifiers ...	100,267	291,733	701,053
Switchgear and switchboards (not telegraph and telephone)	108,170	362,022	594,331
Cathode ray tubes, complete	41,413	321,565	174,076
Other valves, complete	348,285	940,431	1,330,529
Parts (excl. glass bulbs)	68,683	251,725	476,649
Radio receiving sets, domestic or portable	40,376	64,919	154,236
Radio communication and navigational aids, complete	302,975	1,409,562	1,691,112
All other radio and TV apparatus, parts and accessories	335,615	1,321,854	1,366,164
Telegraphy and telephony apparatus ...	56,326	342,024	218,469
Welding machinery	57,358	201,397	263,195
Cooking and heating apparatus	149,302	654,913	663,234
Magnetos, ignition, and electric appliances for aircraft, motor vehicles and cycles...	279,276	605,231	1,169,475
Electro-medical apparatus (incl. X-ray)...	65,248	378,230	445,173
Portable mechanical appliances, electrically operated, complete	106,016	400,753	442,701
Parts	65,783	213,931	249,154
Scientific electrical instruments (excl. telegraphic and telephonic)	130,634	528,421	676,933
Machinery, apparatus and appliances, n.e.s.	1,125,181	2,600,916	4,459,837
TOTAL	3,590,896	11,632,960	15,963,045

GENERATION AND DEVELOPMENT

Thermal Storage Installations Exceed One Million kW

The Electricity Council states that great interest continues to be shown in the rate of installation of electrical thermal storage methods of space heating which can be operated under off-peak conditions, e.g. floor-warming, block heaters and hot-water storage central heating systems. A year ago the total thermal-storage space-heating load in Great Britain was about 750,000 kW, made up of some 350,000 kW of block heaters, 250,000 kW of floor-warming and 150,000 kW of hot-water storage systems. Since then a further 350,000 kW has been connected, including over 200,000 kW of floor-warming. Thus the installed floor-warming load almost doubled during the year, a result which is largely due to the acceptance of this system of heating for domestic dwellings in addition to other premises. In commercial and industrial premises, the use of block heaters has shown a steady expansion. Applications for electrode boilers in conjunction with hot water storage continue to be found, especially in premises not requiring continuous heating.

Interference with Grid

In the High Court of Justice on 24th May Mr. Justice Buckley granted the Central Electricity Generating Board perpetual injunctions restraining Mr. John Brymor Jones, Willow Farm, Staines, Middlesex, from interfering with the Board's workmen erecting or maintaining transmission towers and lines for which statutory authority had been given and from interfering with or damaging such towers and lines.

Action was taken by the Central Electricity Authority in 1957 after the defendant had dislodged a tower on his farm with a sledgehammer as the result of a dispute about compensation.

Analysis of Consumption

The accompanying table, issued by the Electricity Council, shows the electricity sales to the principal classes of consumers in the first quarter of this year and in the year ended 31st March. These figures refer only to kWh metered or billed during the period concerned.

Class of Consumer	Three months ended 31st March, 1960		Twelve months ended 31st March, 1960	
	Million kWh	Increase %	Million kWh	Increase %
Domestic	9,107·1	+11·2	26,899·0	+ 7·9
Farm	491·0	+ 3·8	1,514·4	+ 1·1
Commercial	3,686·5	+10·0	10,542·8	+ 5·7
Combined domestic/commercial	457·2	+ 9·2	1,380·2	+ 6·9
Industrial	12,126·7	+16·7	43,104·0	+12·8
Public Lighting	218·4	+ 8·6	728·7	+ 8·0
Traction	411·3	+ 5·0	1,548·4	+ 2·4
TOTAL	26,498·2	+13·1	85,717·5	+ 9·8

Darlington Service Centre

The newly renovated service centre of the North Eastern Electricity Board at Darlington was officially opened recently by the Mayor (Councillor C. J. Tremewan). The complete ground floor of the old service centre at Skinnergate has been replaced by a large open plan showroom with big vista windows across the full width of the premises, and the entire ground floor is now selling space, alterations having practically doubled the area available for the display of appliances.

The ground floor sales area of the Darlington Service Centre of the North Eastern Electricity Board

The lighting in the centre has been brought up to modern standards. Lighting fittings for the home are displayed in a specially designed alcove.

Improved facilities are provided for consumers paying their accounts. The first floor has been converted into a sales floor and it can also be used for demonstrations to audiences from local organisations. A fully equipped kitchen has been installed in the ground floor where consumers can do "try-it-yourself" tests on any appliance before making the final choice.

The service centre is heated partly by floor warming and partly by thermal storage block heaters.

Football Pitch Anti-frost Installation

It has been discovered that the 20 miles of electric wiring installed two years ago at a cost of £16,000 to prevent the freezing of the playing pitch of the Everton Football Club, Goodison Park, Liverpool, has interfered with the drainage of the ground in wet weather. The wiring, which is ten inches below the surface, is to be removed while the drainage system is being overhauled. It will be put into store until it is required for re-installation.

Electrical Classes for Women

Discussions are taking place between the North Eastern Electricity Board and the Northumberland Federation of Women's Institutes regarding the introduction of classes for women on the use of domestic electrical appliances and the handling of simple electrical problems. The Federation has expressed concern about the number of fatalities which have taken place through domestic appliances, and among other things has suggested that retailers selling appliances should see that they are fitted with proper plugs so that customers do not have to fit their own plugs. Many accidents, the Federation states, have been caused because of ignorance of electrical methods on the part of housewives. The proposed new classes are likely to start in the autumn, and afterwards an examination will be held, and certificates of proficiency given to successful candidates.

South Wales Rural Electrification Nearing Completion

The South Wales Electricity Consultative Council last week approved proposals submitted by the Board for five new stages of its rural electrification programme. Alderman E. Kinsey-Morgan, J.P., chairman of the Council, said that with the exception of some parts of West Wales, proposals for which would be submitted to the Council in a few months' time, this would complete rural development under zonal plans, and the end of the enormous task of bringing electricity to the countryside in South Wales was therefore in sight.

Reviewing what had been achieved, he said that since 1948 the number of farms receiving supplies had risen from fewer than 3,000 (under 13 per cent of the 23,500 farms in the Area) to 14,827 (more than 63 per cent). In 1959-60 alone 1,877 farms had been connected, a record figure for the Board. The capital cost of the work to date had been of the order of £4 million, and in addition large sums had been spent on the provision of high voltage feeders and upon reinforcing the networks in the rural areas.

The work to be executed in Stages 21-25 involved an estimated capital expenditure of more than £1 million and provided for the construction of 130 major schemes, covering supplies to 2,358 farms and 1,126 other rural dwellings. Work on the new stages would in present circumstances be completed during the financial year ending 31st March, 1964, when the overall electrification of farms would reach a figure of 85 per cent some four years ahead of the date originally forecast.

Electricity in Kent

The reason for the selection of a site in Kent for a nuclear power station is the theme of an exhibition which is being staged this month in three Kentish towns, namely, Lydd (Memorial Hall, 3rd to 6th June); Folkestone (Town Hall, 14th to 18th June); and Ashford (Corn Exchange, 23rd to 25th June). The exhibition portrays the story of electricity supply. A graph shows that the demand for power doubles every ten years, and the exhibits include models of a coal-fired power station and a transmission tower, and samples of overhead lines and underground cables. A "Dial a Question" unit broadcasts recorded answers about electricity for inquirers. Details are given of the power station now being built at Richborough which will eventually burn about half the output of the Kent collieries; and pictures and models illustrate the nuclear power station project at Dungeness, the prospects for local employment, the new lighthouse—which has largely been paid for by the Generating Board—and the cross-Channel cable scheme. One section is devoted to the nuclear power station construction programme.

"Manweb" Rural Plans

The proposals for the next steps in the Merseyside and North Wales Board's rural electrification programme show that when Stage 5 is complete there will be 5,846 premises still without a supply of electricity available to them. The Board now proposes to bring into this planned programme 4,895 of these premises. This will benefit all the North Wales counties (including North Cardiganshire) and also parts of Cheshire and Shropshire.

New Y.E.B. Service Centre

The chairman of the Wath-upon-Dearne U.D.C., Councillor W. Cutts, on 5th May officially opened the Yorkshire Electricity Board's new service centre in Sandygate. Among those present was the chairman of the Board, Mr. D. Bellamy, C.B.E. The whole of the shop frontage of the new building is of plate glass, giving an uninterrupted view of the interior, the window line being set back about 4ft to provide protection from the weather. The terrazzo paving of this recess has underfloor wiring to keep it clear of snow and ice, and there are overhead infra-red heaters for the comfort of shoppers in cold weather.

The main showroom is at pavement level, but to take advantage of rising ground to the rear, the building has been designed on the "split-level" principle and from the main showroom a short flight of stairs leads to an upper floor where more appliances are on view. To the rear of this upper floor is a demonstration area. Electric floor warming is used throughout. Illumination in the windows is by high pressure mercury vapour and tungsten lamps, the remainder of the lighting being a combination of fluorescent and tungsten lamps.

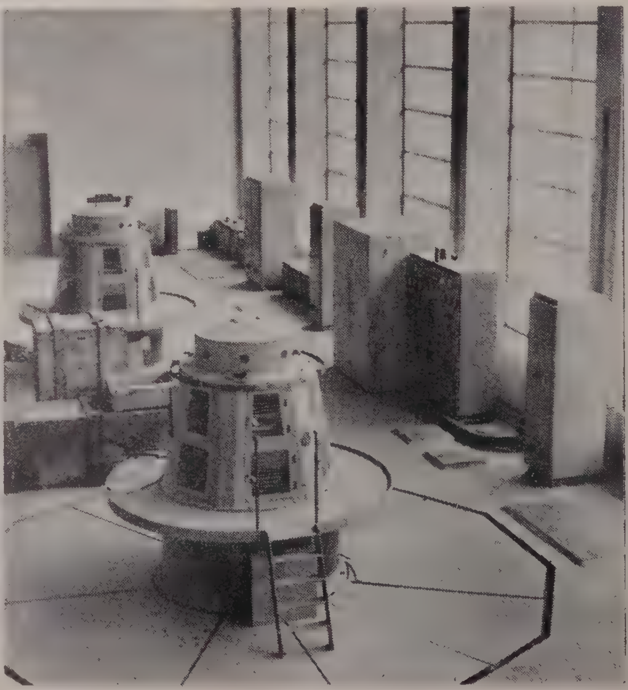
N.E. London Electrification

The Eastern Region of British Railways announces that the new electric train services between Liverpool Street and Chingford, Enfield, Hertford (East) and Bishop's Stortford will be introduced on 21st November.

OVERSEAS

Spanish Hydro-Electric Plant

The first of two 32 MVA waterwheel alternators, supplied by the A.E.I. Heavy Plant Division to Fuerzas Electricas del Noroeste for a new hydro-electric power station on the River Eume, in N.W. Spain, has been commissioned and is now supplying the 132 kV network in Galicia. The Eume power station is some 2½ miles downstream from the dam. Water for the 37,500 b.h.p. Boving turbines is taken through a tunnel and then fed into the penstocks. In this way, because the bed of the gorge slopes steeply, a greater working head is obtained than if the power station were placed close to the dam. The dam is of the modern cupola type and is 338ft high. In addition to the generators, rated at 32 MVA, 600 r.p.m., 0·85 power factor, A.E.I. has supplied to the Eume power station



Turbine hall at the Eume power station two three-phase 32 MVA generator transformers to step up the voltage to 132 kV for distribution; 132 kV circuit-breakers of the "Shuntarc" type, with pneumatic operation; and all control gear for the generator and station auxiliaries.

Malayan Board's First Ten Years

To mark the tenth anniversary of the establishment of the Central Electricity Board, Federation of Malaya, a brochure "Ten Years of Progress" has been published. In an introductory message, Mr. O. A. Spencer, P.M.N., C.M.G., who has just retired from the chairmanship of the Board, says it is easy to forget that when the Board was formed the Federation was grappling with massive problems of post-war rehabilitation. After indicating the rapid progress made, he observes that few people realise how much careful long-term planning lies behind the ready availability and reliability of the country's electricity supply. Over the years of its existence the Board has spent no less than $M200 million on capital account, and the Board already has plans which will involve expenditure of the order of $M300 million over the next eight years.

Australian Power Progress

In the January quarter of this year Australian electricity generation totalled 5,334 million kWh, compared with 4,889 million kWh in the corresponding quarter of 1959, an increase of 9·1 per cent.

Mr. F. Sykes, vice-chairman of the Electricity Commission of New South Wales, is of the opinion that improved coal mining methods and machinery are the most likely field for substantial savings in the future cost of production of electricity. He said recently that the State's natural resources were sufficient to meet all its needs in the foreseeable future and with the proper development of these resources, electricity should be produced at progressively lower cost in the years to come.

The first 16 MW generator at the new Victorian McKay Creek power station has begun commercial operation and the second will go into service within a few weeks. This station is 250ft underground at an elevation of 3,600ft on the slopes of Mt. McKay. It will contain six sets and will be remotely controlled.

A contract has been let for the erection of a diesel-engine power station at Cununurra, Western Australia, the successful tenderer being Rablec, Ltd., acting on behalf of Hawker Siddeley Brush Pty., Ltd. The power house, 60 miles from Wyndham, will house three Mirrlees Brush diesel sets.

Parliamentary Report

Power Station Oil Contracts

In the House of Commons last week Mr. Lee asked the Minister of Power whether the discussions between the Central Electricity Generating Board and the oil companies on the modification of contracts for oil supplies had yet been completed. Mr. Wood said it had been agreed that the Brunswick Wharf and Littlebrook "B" power stations, which were to have been converted to oil this year, should go on burning coal for at least two more years. The possibility of extending the period would be discussed before it ended.

Questioned about agreement on long-term contracts, he said he would not like to go further than he had said. He was not wholly pessimistic and it might be possible to go further, but that was the present position.

Mr. Jeger drew the Minister's attention to a statement made at the recent opening of a power station in Yorkshire that coal burning generating stations were far cheaper than oil burning stations and that Yorkshire stations were the cheapest in the country. Mr. Wood said that in the case to which Mr. Jeger referred the cost of burning oil under contract and the cost of burning coal were similar.

B.B.C. "Satellite" Stations

The Postmaster General announced that he had approved in principle proposals made by the B.B.C. to build low power "satellite" television and v.h.f. sound stations at a number of places. These stations represented the second stage in the B.B.C.'s plans for improving and extending its coverage, said Mr. Bevins. They would bring B.B.C. television to more than 100,000 new viewers and would improve reception for 400,000 more; 350,000 people would get the v.h.f. sound service for the first time. It was hoped to complete these stations by March, 1964. In planning stage three, the B.B.C. had in mind the possibility of installing a new type of very low power "translator" station to bring its television and v.h.f. sound services to towns not at present served and to improve unsatisfactory reception. The television "satellite" station for Hastings was to be an experimental installation of this type.

Nuclear Submarines

Lord Carrington, First Lord of the Admiralty, said in a debate on the naval estimates in the House of Lords that orders would be placed in the next two months or so for a second nuclear submarine. The first nuclear submarine, the *Dreadnought*, was to be launched by the Queen at Barrow-in-Furness on 21st October.

International Institute of Welding

The 1960 annual assembly of the International Institute of Welding is being held in Liège from 12th to 18th June. Meetings of all Commissions will take place and a series of evening lectures by international experts have been arranged on the welding of thick material. One of these lectures is to be given by Dr. H. Harris, of the United Kingdom.

Electricity in the Garden

A REVISED edition of its book "Electricity in Your Garden" has just been published by the British Electrical Development Association. This popular book was first published in 1953 and has since twice been revised; nearly 250,000 copies of the first edition have been distributed, not only in Great Britain but also overseas.

There are three main sections to the book, dealing respectively with the use of electricity in providing heat, light and power. Much of the first section is devoted to explaining how to use electric soil warming to heat a frame. This section also explains the use of electricity in the greenhouse for soil warming and for space heating by tubular heaters, convectors and fan heaters. An important part of the book deals with the practice of mist propagation. Details are also given of the use of electricity in providing automatic watering, leading to the fully automatic greenhouse. Detailed information is included on the use of electric light for providing supplementary lighting during the winter months and, finally, the section on power shows how one can lighten the labour of keeping lawns and hedges in good order by the use of such appliances as electrically operated lawn mowers, long grass cutters, verge trimmers, hedge trimmers and hoe tillers. Copies of the book can be obtained either from the E.D.A., 2, Savoy Hill, London, W.C.2, or from the service centres of the Electricity Boards.

Financial Section

STOCKS and SHARES

INDUSTRIAL markets of the Stock Exchange recovered during the second half of May the whole of the ground lost in the first part. Failure of the Paris conference had no depressing consequences, and the latest returns from the Treasury and the Board of Trade have encouraged hopes that the credit restrictions already imposed by the Chancellor may go far enough to achieve their purposes without need of much reinforcement. Good shares have remained in short supply, so that a moderate volume of new buying is sufficient to keep prices firm.

Firm Markets

Shares of the big electrical groups were well to the fore of a general improvement in prices. By the beginning of this week, A.E.I. were showing a gain of 4s 6d at 59s 3d. English Electric at 41s 9d and G.E.C. at 41s were respectively 2s 6d and 3s to the good. There was a comparable improvement in Reyrolle, to 40s 3d, following the circulation of a market review of the shares, and Enfield Rolling Mills also reacted to favourable comment with a rise of 3s 6d to 52s 6d. Ward & Goldstone advanced 4s to 58s 6d, having touched 60s, their best price of the year, and B.E.T. " A " were bought up to 47s in anticipation of the annual results. Aron Meter were called nominally 70s on reports of an offer for a limited number of shares outside the market. Among many other useful improvements, a rise of 2s 6d in Elliott-Automation, to 25s, again brought the yield on the shares below the 2 per cent level.

Interim Statements

In announcing an interim dividend of 5 per cent, the same rate as for last year but payable on capital since increased by a 25 per cent scrip issue, Crompton Parkinson advised shareholders not to take this necessarily as an indication of a larger total distribution for the year. A sharp rise in the price of the 5s shares to 13s 6d suggested nevertheless that a hopeful interpretation was placed on the decision. Last year's total dividend of 14 per cent is equivalent to 11·2 per cent on present capital. Brook Motors are also maintaining this year's interim payment at the same rate as before, but on increased capital, and this decision is now supplemented by a progress report to the effect that group profits (before tax) expanded by 17 per cent in the first six months of the current year, compared with the same half of 1958–59, reflecting a considerable improvement in the volume of trade. Continued improvement is expected.

Allen West

The 5s shares of Allen West have been well supported since the appearance of the full report containing Mr.

Price Changes in

Company or Board	Nom. Value	Middle price 30th May	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £	s	d	1960 Highest	1960 Lowest
Gilt-edged Stocks						£	s	d		
Brit. Elec. 1968/73	100	76½	+½	3	3	3	18	6	79½	75½
Brit. Elec. 1974/77	100	73		3	3	4	2	3	76	72½
Brit. Elec. 1976/79	100	75½		3½	3½	4	12	9	79½	75½
Brit. Elec. 1974/79	100	85½		4¼	4¼	4	19	6	90½	85½
Brit. Elec. 1967/69	100	93½	+½	4½	4½	4	16	3	97½	92½
Overseas Electric Supply										
Calcutta Elec.	£1	20/6		6·8†	7†	11	3	0	20/9	19/3
East African Power	£1	16/-		7½	8	10	0	0	20/3	16/-
Nigerian Elec.	£1	15/6		8	8	10	6	6	19/9	15/6
Perak Hydro-Elec.	£1	17/6		10	5	5	14	3	17/9	15/3
Electrical Shares										
Aberdare Holdings	5/-	15/9		17½	17½	5	11	0	19/-	15/3
Aerialite	1/-	8/-	+3d	54	54	6	15	0	9/6	7/6
Allen, W. H.	£1	53/9	+2/6	11	12	4	9	3	60/-	51/3
Allied Insulators	5/-	20/-		—	20	5	0	0	23/3	20/-
Anglo-Portuguese Tel.	£1	29/-	+9d	9	9	6	4	3	29/-	26/-
Arcolectric	1/-	4/3		—	15	3	10	6	5/6	4/-
Aron Elec. Ord.	£1	70/-	+8/-	15	15	4	5	9	70/-	47/-
Assoc. Elec. Ord.	£1	59/3	+4/6	15	15	5	0	9	66/6	50/6
Automatic Tel. & El.	5/-	17/3		17	17	4	18	6	21/9	17/3
Babcock & Wilcox	£1	38/3	+1/9	13	9	4	14	3	48/9	33/6
Bakelite	10/-	52/6	+1/6	15	17½	3	6	9	52/6	40/-
Baldwin, H. J.	2/-	2/-	−6d	20	—		—		2/6	2/3
Berry's Electric	5/-	34/6	+1/-	10	20‡*	2	18	0	38/-	29/6
Bowthorpe Holdings	2/-	8/9	+9d	27	18½*	4	4	6	11/6	8/
British Elec. Traction:										
Def. Ord. " A "	5/-	47/-	+5/-	25	35	3	14	6	49/3	42/-
B.I. Callender's	£1	52/-		13½	13½	5	3	9	61/-	50/-
B.I. Callender's 6% Pref. ...	£1	20/-		6	6	6	0	0	21/-	19/9
British Thermostat	5/-	22/9		35	20*	4	8	0	26/-	21/3
Brook Motors	10/-	46/3	+1/3	25	25*	4	12	9*	53/6	45/6
Bulgin, A. F.	1/-	9/6		50	55	3	17	0*	10/3	8/-
Bulpitts	5/-	17/6		15	16½	4	12	9	23/3	17/-
Burco Dean	5/-	12/9	−6d	16	18		—		15/9	12/6
Cable & Wireless	5/-	16/6	+1/-	10	10*‡	3	0	6	18/3	14/3
Chloride El. Storage " A " ...	£1	72/6	+1/3	20	17½*	4	16	6	74/-	65/6
Clarke Chapman	£1	48/9		13¾	13¾	5	12	9	63/6	48/9
Cole, E. K....	5/-	23/3	+9d	17½	20	4	6	0	31/9	22/-
Contactor Switchgear	5/-	16/6		14	14	4	4	9	17/9	15/9
Cossor, A. C.	5/-	7/3		Nil	5	3	9	0	10/-	7/3
Crabtree	10/-	24/-	+6d	20	22½‡	4	13	9*	28/3	24/-
Crompton Parkinson	5/-	13/6	+1/3	12	14	4	3	0*	15/-	11/9
Davis & Timmins	5/-	26/3		20	25	4	15	3	28/9	21/-
De La Rue	10/-	70/-	+6/-	17½	20	2	17	3	73/6	62/-
Decca " A "	10/-	45/9	+1/3	50	20*	4	7	6	51/3	42/-
Desoutter	5/-	42/-		21⅜	30	3	11	6	42/-	37/6
Dewhurst	2/-	7/6		20	20	5	6	9	8/6	7/6
Dictograph Tel.	2/-	9/6		20	20	4	4	3	9/9	9/-
Dimplex	5/-	30/-		—	25‡	4	3	3	32/6	26/9
Dubilier Condenser	1/-	5/6		20	25	4	11	0	6/-	5/-
Duport	5/-	26/-	+2/6	12½	17½	3	7	3	30/3	22/-
E.M.I.	10/-	50/-	+1/6	20	14*‡	2	16	0	58/9	45/-
Electrical Apparatus	5/-	15/-		14½	14½	4	16	9	15/-	12/9
Electrical Components	5/-	9/6		12½	15	5	5	3*	13/9	10/-
Elec. Construction	£1	37/6		8½	9	4	16	0	43/-	35/3
Elliott-Automation	5/-	25/-	+2/6	—	9·3*	1	17	3	25/-	19/9
Enfield Rolling Mills	£1	52/6	+3/6	15	15	5	14	3	56/3	48/-
English Electric	£1	41/9	+2/6	14	10*	4	15	9	53/-	38/9
English Electric 3¾% Pref. ...	£1	12/6		3¾	3¾	6	0	0	13/-	12/6
Ericsson Tel.	5/-	22/6		13†	13†	4	14	3	28/6	22/6
Ever Ready	5/-	25/6		27½	20*	3	18	6	27/3	23/-
Falk Stadelmann	£1	32/-		10	10	6	5	0	35/9	32/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

M. W. H. Lancaster's review of the situation. They had earlier been on the dull side as a reflection of the preliminary statement of the results for 1959–60 showing profits a little below the previous year's. This contraction is now explained by the chairman as the outcome of a decline in new orders during 1958 and consequently lower output in the following year. He describes prospects now as much brighter. Orders taken last year were 16 per cent higher, in comparison with 1958, and the position in this respect is better than it has ever been. At a price of 13s the shares show a yield of about 4¾ per cent on the basis of the 12½ per cent dividend, without taking into account the supplement of a 1 per cent jubilee bonus.

Electrical Investments

Company or Board	Nom. Value	Middle price 30th May	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1960 Highest	1960 Lowest
Electrical Shares—continued						£ s d		
G.E.C.	£1	41/-	+3/-	10	10	4 17 6	47/6	37/-
G.E.C. 6½% Pref.	£1	21/-		6½	6½	6 3 9	22/3	21/6
General Cables	5/-	5/9	−3d	15	Nil	—	10/-	5/9
Goblin (B.V.C.)	5/-	9/6	−3d	7½	12½	6 11 6	13/9	9/9
Hackbridge Holdings	5/-	15/9		20	20	6 7 0	17/3	15/-
Hackbridge & Hewittic	5/-	14/3		20	20	5 5 3*	15/-	13/-
Head Wrightson	5/-	22/6	+1/3	20	14*	3 2 3	31/6	21/3
Heatrae	2/-	12/-	+6d	20	22½	3 15 0	12/3	8/9
Holophane	5/-	18/-		22½	26	7 4 6	20/6	17/6
Hoover	5/-	50/-		60	90	4 10 0*	55/-	45/-
Intl. Combustion	5/-	28/9	+6d	30	30	5 4 3	46/9	26/6
Intl. Computers & T.	£1	67/6	+1/3	—	10	2 19 3	78/6	61/6
Johnson & Phillips	£1	20/-	−1/-	5	5	5 0 0	24/-	20/-
Laurence Scott	5/-	20/-	+6d	15	15*	3 15 0	25/3	18/-
Lister, R. A.	£1	52/6		12½	14	5 6 9	62/-	52/6
Lucas, J.	£1	65/6	+6d	10	12½	3 16 3	74/6	65/-
Marryat & Scott	2/-	15/-		37½	22½*	2 19 0	16/9	14/3
Mather & Platt	£1	48/9	+1/3	10⅜	11	4 10 3	59/-	47/6
Metal Industries	£1	64/6	+2/-	14	15‡	4 13 0	76/3	61/3
Midland Elec. Mfg.	£1	58/9		10	12	4 2 0	58/9	53/6
Morphy-Richards	4/-	21/6	+1/-	20	25	2 6 6*	22/-	16/3
Murex	£1	68/9	+1/3	17½	15	4 7 3	77/-	62/6
Newman Ind.	2/-	5/3		10	12½	4 15 3	5/3	4/-
Oldham & Son	1/-	3/3		17½	17½	5 7 9	3/3	2/9
Parsons, C. A.	£1	53/-	+2/-	8⅓	9⅜	3 10 9	59/-	46/-
Philips' Lamps	Fl.10	198/9	+11/3	13·3	16	1 12 3	£10	137/-
Plessey	10/-	50/-		20	14*‡	2 16 0	54/6	44/3
Pye	5/-	16/9	+3d	12½	12½*‡	3 14 9	19/-	16/-
Pyrotenax	5/-	56/-	+1/-	—	34	3 0 9	56/-	44/3
Radiation	£1	38/6	−3d	6	12	6 4 9	44/6	34/6
Reliance Clifton	5/-	23/-	+1/-	15	15	3 5 3	28/-	22/-
Reyrolle	£1	40/3	+2/3	17½	17½	4 7 0*	52/3	38/-
Rheostatic	4/-	15/3x.c.	−6d	20	18¾*‡	4 18 3	16/6	12/6
Richardsons Westgarth	10/-	10/9	−3d	8⅓	8⅓	7 14 0	14/9	10/9
Sangamo Weston	10/-	20/-		12½	11*	5 10 0	22/9	19/3
Simon-Carves	5/-	48/6	−1/6	25	35	—	54/-	36/-
Smith (England), S.	4/-	16/9	+6d	12½	17½	4 3 6	20/-	16/-
Southern Areas	£1	14/6		Nil	5	6 18 0	15/6	13/-
Strand Elec.	5/-	15/9	−3d	15	20	6 7 0	20/3	15/9
Sturtevant	5/-	15/-		15†	15†	8 3 3	24/3	15/-
Sun Elec.	5/-	15/9	+6d	25	15*	4 15 3	16/3	15/-
Switchgear & Cowans	5/-	16/-		15	17½	5 9 6	18/9	16/-
T.C.C.	10/-	46/3		25	35	5 1 0*	48/3	37/3
Telephone Mfg.	5/-	5/6	−3d	10	5	4 11 0	7/3	5/-
Telephone Rentals	5/-	20/3	+3d	12½	15*	3 14 0	20/3	17/-
Thompson (John)	5/-	18/3	−3d	25	20	5 9 6	25/9	17/3
Thorn Elec.	5/-	48/3	+9d	17½	20	2 1 6	55/6	44/3
Thorneycroft	£1	25/-	+1/3	7½	6	4 16 0	31/-	23/-
Tube Investments	£1	78/9		20	13‡	3 6 0	95/6	65/3
Vactric	5/-	33/9	+1/3	25	37½	5 11 0	43/9	32/-
Walsall Conduits	4/-	13/9		22½	22½	3 14 3*	16/-	13/9
Ward & Goldstone	5/-	58/6	+4/-	25	30	2 11 3	60/-	51/3
Watford	2/-	11/6		25	25	4 7 0	17/6	11/-
Westinghouse	£1	50/-	+1/-	10	11	4 8 0	59/9	49/-
West, Allen	5/-	13/-	+3d	12½	12½*	4 16 3	17/-	12/6
Wilkins & Mitchell	5/-	20/-		15	17*	4 5 0	25/9	19/9
Wolf Electric	5/-	12/9	+6d	10	12½	4 18 0	13/3	10/9

Murphy Radio Issue

Murphy Radio are raising the best part of a million new capital by a "rights" offer of 728,000 new 5s ordinary shares in conjunction with an issue of 500,000 6½ per cent preference shares. At the company's annual meeting shareholders were told that the demand last year for the radio and television equipment stretched resources to the utmost, while the electronics division had been engaged to full capacity and was expected to remain so. Dealings in the new ordinary shares have been taking place at a premium of around 4s 3d on the issue price of 13 6d.

Simon Group

The shares of both Simon-Carves and Simon Engineering were quoted rather lower, at about 48s 6d and 47s 9d respectively, after publication of the details of the merger, although the terms were in fact very much in line with expectations. Ordinary shareholders of both companies are to receive, in effect, 150 shares of 5s in Simon Engineering, the new holding company, and £25 cash, for each 100 shares now held. Simon-Carves shareholders also receive a small allotment of preference shares. Dividends totalling 26⅔ per cent (following a 50 per cent scrip issue) on the new company's shares are forecast and would be equivalent to payments of 40 per cent, or 5 per cent more than current rates, on the existing shares.

Burco Dean

In announcing a reduction in the interim dividend for the current year from 6 to 5 per cent the directors of Burco Dean recall previous advices to shareholders to the effect that in the process of transferring production to new factories, and of launching the new washing machine, some disorganisation of business and considerable expenses were unavoidable. Turnover is said in the company's statement to be increasing and although profit margins will be lower than last year business is now on a satisfactorily profitable basis. With the usual reservations, the intention is to recommend a final dividend of not less than 10 per cent for the year ending next September. For 1958–59, when net profits expanded from £193,000 to £257,000 after tax, the interim of 6 per cent was followed by a final payment of 12 per cent.

REPORTS and DIVIDENDS

Laurence, Scott & Electromotors, Ltd.—The annual meeting was held on 25th May, Mr. G. H. Wilson (chairman and managing director), presiding.

In the course of his statement, which had been previously circulated, the chairman said that new orders booked in 1959, although not quite up to those of 1956 and 1957, were a great improvement on those of 1958, and the strengthening of the order book had been well maintained in the current year in spite of fierce competition, from which it appeared that there was still spare manufacturing capacity in the industry. This condition might be expected to continue and indeed increase as price agreements, intended to prevent excessive price cutting, were abandoned. Generally speaking, the increase in their order book was not confined to any one particular source, but represented a revival in many of their traditional markets both at home and overseas. Although no general revival in shipbuilding was apparent, they had nevertheless booked some important contracts in the marine field.

One particularly large contract booked during the year was from Crompton Parkinson, Ltd., for traction generators and motors to be manufactured to their design for British Railways. The extension designed to enlarge their range by undertaking the manufacture and testing of larger and heavier machines was now in full production. Included in its programme were the largest a.c. commutator variable speed motors ever built in this or any other country. They were already planning to extend this shop.

Hopkinsons, Ltd.—The annual meeting was held on 26th May, Mr. R. L. Brown (chairman and managing director), presiding. In his circulated review of 1959, the chairman said that capital expenditure during the year was £172,067, mainly to meet the demand for larger valves now required in the power industry. The volume of orders received had been maintained at the previous year's level, but sales had shown an increase of 7 per cent on the previous year. They were now in a position to give shorter deliveries. Capital schemes in which they were interested were slow to develop, and the incoming orders were still below their capacity. They had, however, sufficient work in hand to maintain the organisation in full production during the current year, with the exception of certain ranges of small valves where their productive capacity had been greatly increased. Export orders had again increased during the year under review. During the year they had received orders for "Tansphere" valves for the reactors, also valves and mountings for the heat exchangers, for the Trawsfynydd nuclear power station of the C.E.G.B. and further prospects were developing.

Simon-Carves, Ltd.—The financial results for 1959 were given in our issue of 15th April. In his statement, which accompanies the report and accounts, Mr. R. B. Potter (chairman) refers to the proposed merger with Henry Simon (Holdings), Ltd., and says that the two companies have grown up together for some eighty years as separate and independent businesses, but they have many common interests, especially on the financial and management sides.

Dealing with the past year's trading, he says that the group results were a record, the profit, before taxation, being about 10 per cent higher than in 1958, although the turnover was slightly lower. The company's business both at home and abroad continued at a satisfactory level during the year and benefited, from a profit point of view, from the completion of certain large contracts. The order book is somewhat higher than a year ago, and prospects for the next few years are encouraging. Heavy engineering was still depressed during the early part of the year, but there was a marked though gradual improvement towards the end which has continued into 1960. While there were important developments in the steel industry, relatively few orders were placed by the National Coal Board and the C.E.G.B. There are encouraging prospects in comparatively new lines of business, which will be increasingly important in the future. They again concentrated their efforts on the export market, and a serious effort is being made to break into the Canadian market; recently a subsidiary company was registered in Toronto.

Commenting on the individual sections of the business, Mr. Potter says, in referring to the Power Plant Department and Nuclear Power Division, that there was no significant improvement in the prospects for orthodox thermal power stations and the only important contract of 1959 was for the rehabilitation of the power station at the Abadan refinery of Iranian Oil Services. There are now signs that the C.E.G.B. is stepping up its programme, and the company is dealing with a number of inquiries; in addition firm inquiries are now being received from the private sector of industry. The problem of surplus capacity is common to all United Kingdom boiler builders, and some form of rationalisation of the industry is under discussion. They have arranged a mutually satisfactory method of co-operation with International Combustion, Ltd. On the nuclear side they succeeded in getting their share of the Japanese nuclear power station contract negotiated by the General Electric Co., Ltd., on behalf of the G.E.C./Simon-Carves group. The effect of labour troubles at the Hunterston nuclear station will be a delay of at least twelve months in commissioning the station. The department is now busy preparing a tender for the projected nuclear power station at Sizewell.

Henry Simon/Simon-Carves Merger.—Details were announced last week of the proposed merger of Henry Simon (Holdings), Ltd., and Simon-Carves, Ltd. Henry Simon is a beneficial owner of 765,926 ordinary shares of 5s each of Simon-Carves, and Simon-Carves is the beneficial owner of 257,775 preference shares of £1 each and 360,506 ordinary shares of 5s each of Henry Simon. The plan provides for the elimination of these inter-company holdings, and the formation of a holding company, whose shares will be held by the outside shareholders of Henry Simon and Simon-Carves (i.e. shareholders of each company other than the companies themselves).

Henry Simon will change its name to Simon Engineering, Ltd., and will own all the issued share capitals of Simon-Carves and of a new company which will take the name of Henry Simon (Holdings), Ltd., and to which Henry Simon will transfer its existing business. The outside ordinary shareholders of both companies will receive a cash payment of 5s in respect of each 5s ordinary share held. The outside shareholders of Henry Simon will continue as shareholders in Simon Engineering and the shares in Henry Simon at present held by Simon-Carves will be cancelled. The outside ordinary shareholders of Simon-Carves will receive shares in Simon Engineering on a share-for-share basis in place of their shares in Simon-Carves which will be cancelled. Simon Engineering will make a 50 per cent scrip issue in ordinary shares to its own outside ordinary shareholders and to the former outside ordinary shareholders of Simon-Carves. Outside ordinary shareholders of Simon-Carves will receive an allotment of preference shares in Simon Engineering in the

[*Continued on page* 1085

the name behind the driving power of industry

G.E.C.

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A44

WHY INDUSTRY IS CHANGING TO CLASS C AND CLASS H TRANSFORMERS

THEY ARE FAR BETTER

Class C & Class H *silicone-insulated, dry-type transformers are fire and explosion proof. They are not affected by dust and humidity. And because they will withstand repeated overloading, rating does not have to be based on peak loads. For safety, reliability and low maintenance costs, silicone-insulated transformers hold every advantage.*

THEY ARE OFTEN CHEAPER

First consider all the expenditure incumbent upon the installation of oil-filled transformers. Special bunkers and fireproof vaults are usually needed—and special fire-fighting equipment. The installation is often located a considerable distance from the load centre—which implies expensive low-voltage cable runs.

Now consider the very considerable cost-cutting advantages of Class C and Class H transformers as demonstrated for instance at the Kent factory of Medway Paper Sacks Ltd, a member of the Reed Paper Group. Here a 750 kVA 3-phase air natural cooled transformer, built by Ferranti Ltd, has been neatly mounted within the roof truss space. Space limitations—making it undesirable to build an adjoining substation for a Class A unit—together, of course, with freedom from fire hazard, were the major considerations. As a Group technician pointed out, the transformer's low weight enabled it to be sited thus, on a moderately-sized platform, making it possible to run 'a very nice low voltage distribution' to individual machines without floor excavations to accommodate long, costly cable runs.
And so, in simple indisputable terms, it often costs less to have all the advantages of a Class C or a Class H installation.

Midland Silicones Ltd supply the silicone resins and elastomers used in the manufacture of Class C and Class H transformers. Here is a list of well-known British manufacturers producing silicone-insulated dry-type transformers for the United Kingdom and overseas.

Associated Electrical Industries (Manchester) Ltd
Bonar, Long & Co Ltd
Brentford Transformers Ltd
Brush Electrical Engineering Co Ltd
Bryce Electric Construction Co Ltd
Crompton Parkinson Ltd
The English Electric Co Ltd
Ferranti Ltd
Foster Transformers Ltd
The General Electric Co Ltd
Gresham Transformers Ltd
Hackbridge & Hewittic Electric Co Ltd
London Transformer Products Ltd
Bruce Peebles & Co Ltd
South Wales Switchgear Ltd
Transformers (Watford) Ltd
Woden Transformer Co Ltd
The Yorkshire Electric Transformer Co Ltd

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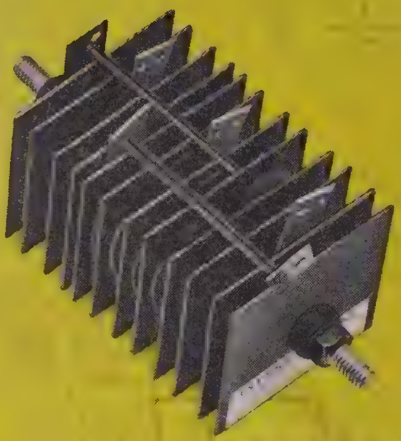

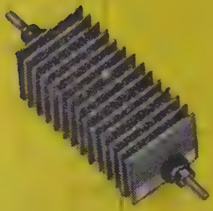

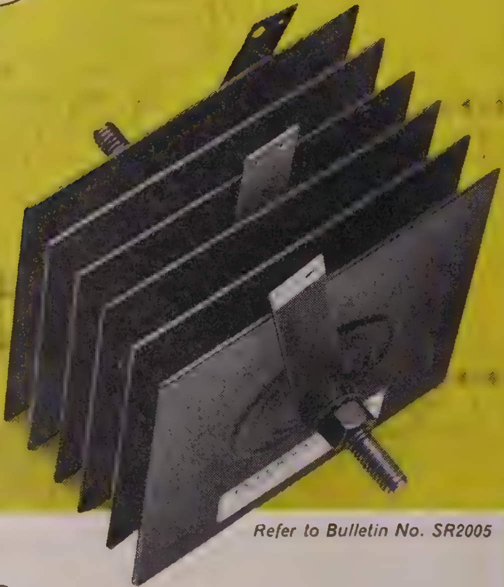

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FINANCIAL SECTION (*Continued*)

ratio of one for every 15 ordinary shares held in Simon-Carves. The outside preference shareholders of Henry Simon, in consideration of their approving the scheme, will be allotted further preference shares, credited as fully paid, in the ratio of one new share for every four held.

Allen West & Co., Ltd.—The financial results for the year to 31st January last were summarised in our issue of 29th April. In his statement which has been circulated with the report and accounts, Mr. M. W. H. Lancaster (chairman) mentions that this year the company is celebrating its golden jubilee, and in addition to a golden jubilee bonus of 1 per cent to stockholders, making the total distribution for the year 13½ per cent, the directors have decided to distribute a sum of money equal to the 1 per cent bonus to all employees, including employees of the subsidiary companies overseas. In March of this year the new electrical proving station and research laboratories were officially opened by Sir Henry Self. (See *Electrical Review*, 25th March, p. 580.)

The subsidiary companies in South Africa, Rhodesia and Canada continue to prosper. The Canadian company has doubled its sales in the last five years, and a new branch office has been opened in Toronto. The disturbances in South Africa have not so far affected their trade in that country. The book value of the assets of the wholly owned South African subsidiary has now reached a figure where it is advisable to capitalise some of the reserves and accordingly a capital bonus issue of three new shares for each one issued is being made to the parent company.

With regard to the future, the prospects are far brighter than they were a year ago. The orders received last year were 16 per cent up on the year before and the unexecuted order position today is higher than it has ever been.

The Harland Engineering Co., Ltd.—In the course of his review of 1959, which has been circulated to shareholders, Mr. H. Cowan-Douglas (chairman) says that the combined parent company and Harland Drives invoiced sales turnover at £3·2 million is 25 per cent up on 1958. Order intake at £2·1 million shows a considerable falling off, arising partly from increased competition and partly from the fact that the order book position compelled them to quote long dispatch times. Orders in hand now represent about one year's output and they are in a better dispatch position for booking orders in 1960. The ratio of export to total orders was only fractionally lower than for the previous year. Among the major items of plant delivered or booked during 1959 were boiler-feed pumps, hydro-electric turbines and generators for home and overseas, pumping installations for steelworks in India and elsewhere, waterworks equipment and Rotovalves, largely for overseas territories. Valuable contracts are being executed for the Admiralty, for whom they are also undertaking special development work in connection with the *Dreadnought*.

The intake of orders on contract work has been well maintained. There has been a welcome increase in hydro-electric orders, mainly from the North of Scotland Hydro-Electric Board. The money value of orders for boiler-feed pumps has been maintained but, with the adoption of larger units in thermal power stations at home and abroad, the number of units has fallen materially.

It was announced last week that trading activities of Harland Drives, Ltd., would be transferred to a division of the parent company as from 1st June and its business would be carried on under the name of the Harland Engineering Co., Ltd.—Drives Division.

Vickers, Ltd. — The report and accounts for 1959 contain an illustrated review of the activities of the companies in the group. Reference is made to the first deliveries during the year by the Metropolitan-Cammell Carriage & Wagon Co., Ltd., of the 532 Piccadilly tube cars for the London Transport Executive, and output of these cars will continue throughout 1960. After a falling-off in orders received by Cooke, Troughton & Simms, Ltd., in the early part of the year, the position improved; the subsidiary company, C. Baker Instruments, Ltd., had an encouraging year's trading. Ioco, Ltd., was active in improving and extending its range of industrial plastics for the electrical, mechanical and civil engineering industries. The technical resources of the company were strengthened with the object of developing new materials for the electronics and radio industries, as well as the well-established insulation products used in the electrical industry.

The highlight of the year for Vickers Nuclear Engineering, Ltd., was the laying of the keel of the submarine *Dreadnought* by the Duke of Edinburgh at Barrow. Work also continued on the British-designed submarine prototype machinery at Dounreay. The nuclear part of the design is being carried out by Rolls-Royce & Associates, Ltd., the associates being Vickers and Foster Wheeler. A design study of a steam-cooled heavy water moderated reactor was presented to the Government Committee which is considering the application of nuclear power to merchant ship propulsion. This study was carried out by the three partners in Vickers Nuclear Engineering—Rolls-Royce, Foster Wheeler and Vickers-Armstrongs. During the year Vickers also became associated with the English Electric Co., Ltd., in the application of organic moderated reactors to merchant vessels. In order that the reactor propulsion system shall be entirely suitable for marine use, Vickers supplied naval architects and marine engineers to work with the English Electric reactor design team.

Burco Dean, Ltd., has announced an interim dividend of 5 per cent (against 6 per cent). In making the announcement, the directors state that with turnover increasing the business is now on a satisfactorily profitable basis, although profit margins are lower than last year. Subject to no unforeseen circumstances arising, the directors intend to recommend a final dividend of not less than 10 per cent for 1959-60 (against 12 per cent), and they feel that this dividend will be adequately covered by profits.

Southern Areas Electric Corporation, Ltd.—In the course of his address at the recent annual meeting, Lord Gridley (chairman) said that in an endeavour to extend their market and increase their order intake, the staff of sales engineers had been augmented. In the latter months of last year, although the market remained highly competitive, the volume of orders procurable and obtained increased to some extent. This was the experience of the group in general and also of their largest subsidiary, Mawdsley's, whose order intake, although improved, was still causing some concern. If the rate of business obtained in recent months was sustained, profits for the current year should at least suffice to maintain the dividend rate.

The Electricity Board for Northern Ireland.—The list of applications opened and closed on Wednesday last for an issue of £5 million 5½ per cent guaranteed stock, 1979-82, at a price of £96½ per cent. Interest will be payable half-yearly with a first payment of £1 2s 6d per cent on 1st October next. Redemption is at par on 1st October, 1982, with earlier redemption in whole or in part on or after 1st October, 1979, at the Board's option. The proceeds of the issue will be used for the repayment of existing short-term temporary borrowings already incurred on the development in Northern Ireland of electricity generation and distribution.

Firth Cleveland Acquisition.—Last week Mr. C. W. Hayward (chairman) announced the acquisition by Firth Cleveland, Ltd., of J. J. Habershon & Sons, Ltd., Holmes Mills, Rotherham, rollers of steel strip, from the Iron & Steel Holding and Realisation Agency, for £700,000, for the whole of the issued share capital, and £400,000 for the outstanding loan due by Habershon to I.S.H.R.A.

This new acquisition will bring the turnover of the Firth Cleveland steel interests to about £11 million currently.

The Drayton Regulator Co., Ltd., reports that after providing £140,163 for taxation, the net profit for 1959 is £145,038, as compared with £118,993 for 1958. A final dividend of 15 per cent is proposed, making 22½ per cent for the year.

Mr. P. H. Lloyd (chairman) in his review of the year, refers to new developments. Drayton Controls (Heating), Ltd., a subsidiary, has now been formed and is developing satisfactorily. A number of new products has been put into production, notably the teletronic controller—an indoor-outdoor controller with electronic sensing. For the various projects substantial funds will be needed which will require additional finance. The time for such an operation is not yet ripe, and in the interim, suitable arrangements for immediate needs have been made with the company's bankers.

The London Brick Co., Ltd.—Speaking at the annual meeting held on 24th May, Mr. A. T. Worboys (chairman) referred to Transformers (Watford), Ltd., the manufacturing subsidiary, the factory output of which reached a record level. The trading profit also showed an upward trend. A new main assembly shop capable of handling units up to 100 tons in weight was now being undertaken on a newly acquired site adjacent to the factory, and would facilitate the production and testing of the larger high voltage system transformers which now figured more prominently in the output of the factory. The value of orders on hand at the close of the year was not unsatisfactory.

The Ever Ready Co. (Great Britain), Ltd., reports group profits for the year to 27th February last of £2,735,128, as compared with £2,430,553 for the preceding year, and after providing £1,184,146 for taxation, the net profit is £1,550,982, an increase of £288,126. It is proposed to pay a final dividend of 15 per cent, making 20 per cent for the year on capital as increased by a two-for-three scrip issue (against 27½ per cent, including a special interim dividend of 7½ per cent, on the old capital). A surplus of £537,781 arising from the revaluation of a trade investment has been credited to capital reserve.

Metal Industries, Ltd., has announced the terms of its forthcoming "rights" issue. Members are being offered one new £1 ordinary share at 54s for every £4 ordinary stock held. These proposals entail the issue of 1,479,600 ordinary shares, thus increasing the company's issued share capital to £10,247,123.

At an extraordinary general meeting of stockholders held on 30th May approval was given for the authorised capital to be increased from £10 million to £15 million. The directors state that the company's accounts for the year to 31st March last are not yet available but they expect that the profits will be about £2·5 million. This figure represents the total profits of the companies formerly in the Lancashire Dynamo group for the year to 31st December last and for the remaining companies in the Metal Industries group for the year to 31st March last, after charging depreciation and all expenses but before charging income tax and profits tax. They are of the opinion that, provided there is no serious deterioration in trading conditions, the profits for the current year should not be materially different from the figure indicated above. In this event the directors would propose to pay interim and final dividends for such year amounting together to 15 per cent as increased by the "rights" issue.

Heatrae, Ltd., reports a net profit for the year to 29th February last of £24,759, as compared with £15,156 for the preceding year. It is proposed to pay a dividend for the year of 22½ per cent (against 20 per cent).

Crompton Parkinson, Ltd., has declared an interim ordinary dividend of 5 per cent (unchanged) on increased capital. The increased amount to be distributed should not be taken as an indication that the total distribution for the year will necessarily be increased.

The Plessey Co., Ltd., has announced an interim dividend of 7 per cent (against an equivalent of 6 per cent, after allowing for a scrip issue).

The British Aluminium Co., Ltd., has declared an interim dividend of 4 per cent.

New Companies

Solartron-John Brown Automation, Ltd.—Registered 27th April. Capital £100,000. Solicitors: Slaughter & May, 18, Austin Friars, E.C.2.

Maypole Electrical, Ltd.—Registered 25th April. Capital £1,000. Manufacturers of and dealers in electrical goods, etc. Directors: S. W. Sullivan, Mrs. Violet V. Harris and Mrs. Maria M. West. Regd. office: 56, North Street, Romford, Essex.

W. H. Bastin & Son (Electrical), Ltd.—Registered 23rd March. Capital £1,000. Electrical contractors, etc. Directors: W. H. Bastin and Mrs. May D. F. Bastin. Regd. office: 77, Barking Road, E.6.

Foley Electrical (Manchester), Ltd.—Registered 19th April. Capital £5,000. Electrical engineers, etc. Regd. office: 18, Charing Cross Road, W.C.2.

Liquidations

Wares (Portsmouth), Ltd., electrical and hardware merchants, 263-265, Fratton Road, Portsmouth.—Winding up. Liquidator, Mr. M. D. Brewer, 14, Hampshire Terrace, Portsmouth, appointed 16th May. Particulars of claims to the liquidator by 11th June.

T. K. Richardson & Co., Ltd., electrical contractors, 66, Aigburth Road, Liverpool.—Winding up voluntarily. Liquidator, Mr. C. A. Huntington, Eric S. Browne & Co., 41, North John Street, Liverpool, 2, appointed 12th May.

Easiway Electrical Co., Ltd.—Particulars of claims to the liquidator, Mr. L. H. Shipton, 31, Lloyd Street, Manchester, 2, by 30th June.

Unique Products (Bridlington), Ltd., electrical fittings dealers, 15, Cliff Street, Bridlington.—Winding up. Liquidator, Mr. R. W. Hellyer, Brotherton Chambers, Westgate, Leeds, 1, appointed 20th May.

Carlton Electrical Co., Ltd.—Meeting of members on 4th July at Woolgreaves, Sandal, Wakefield, to receive an account of the winding-up by the liquidator, Mr. H. F. Rudd.

Bankruptcies

R. A. G. Newman, lately trading as Nordon Electrics, at 109, Stanstead Road, Forest Hill, London, S.E.23, as an electrical dealer salesman.—Receiving order made 18th May on debtor's own petition.

G. Love and **F. E. Love,** trading as Love Bros., Holt Road, North Elmham, Norfolk, cycle, radio and electrical engineers and newsagents.—Trustee, Mr. C. A. Taylor, Norfolk House, Exchange Street, Norwich, Official Receiver, released 19th May.

N. Sherman and **B. Bercovici,** lately trading together as B.B. Radio and Television Service, and B.B. Radio, at 168, Roman Road, London, E.2, radio, television and electrical equipment dealers.—First and final dividend of 3s 1¾d in the £, payable on and after 23rd June at Walter House, 418-422, Strand, London, W.C.2.

H. Rose, 158, Soho Road, Handsworth, Birmingham, trading as Rose Electrical Service, electrical contractor and dealer.—Supplemental dividend of 6½d in the £, payable on and after 7th June at the Official Receiver's office, Somerset House, 37, Temple Street, Birmingham.

J. R. Marsh, trading with another as A. H. Percival & Co., at 13 and 14, Spencer Road, Ryde, I. of W., electrical dealer and contractor.—Receiving order made 10th May on debtor's own petition.

A. H. Percival, trading with another as A. H. Percival & Co., at 13 and 14, Spencer Road, Ryde, I. of W.—Receiving order made 10th May on debtor's own petition.

C. W. G. Gunther, F. G. M. Gunther and **P. G. Bowen,** 21, Chiswick Lane, London, W.4, formerly residing at 1, Bolton Road, Chiswick, W.4, and trading as Grove Electrical Appliances at 758, Fulham Road, London, S.W.6, as electrical retailers.—Receiving order made 29th April on debtors' own petition. Public examination 22nd June at Bankruptcy Buildings, Carey Street, London, W.C.2.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

The Earl of Verulam, M.A., Companion I.E.E., Hon. M.I.H.V.E., F.B.I.M., J.P., is to succeed Sir Josiah Eccles as president of the Association of Supervising Electrical Engineers in October next. Lord Verulam is chairman of Enfield Rolling Mills, Ltd., the Engineering & Lighting Equipment Co., Ltd., and Sternol, Ltd. He was educated at Eton and Christ Church, Oxford, and after four years (1932-36) in the zinc rolling mill of Firma Friedrich von Neuman, Austria, and in the workshops of Vereinigte Deutsche Metallwerke A.-G., Nurnberg, Germany, founded Enfield Zinc Products, Ltd. From 1935 to 1939 he was area organiser of the Eastern Valley Subsistence Production Society in South Wales, and from 1936 to 1954 was with Enfield Cables, Ltd., being managing director from 1943.

Lord Verulam

At the invitation of American Universities, **Dr. S. Gill,** research mathematician with the Computer Department of Ferranti, Ltd., left for the United States recently to lecture on the new high-speed parallel computer, "Atlas," being built jointly by Ferranti, Ltd., and Manchester University. Dr. Gill is one of the lecturers at a short course on "Controlling and Exploiting Giant Computers" being held by the University of California, Los Angeles, and he will also visit the Universities of Chicago, Illinois, North Carolina and Toronto, and the Massachusetts Institute of Technology. In Washington he will deliver a paper on "Atlas" to the American Bureau of Standards.

Mr. B. Swann, sales manager of the Computer Department of Ferranti, Ltd., and **Mr. G. Felton,** chief programmer for the "Orion" computer system, have represented the company at the first Australian conference on automatic computing and data computing which was held in Sydney from 24th to 27th May.

Dowding & Mills, Ltd., announce the following appointments:—**Mr. P. L. Hollings,** London manager, has been appointed a company director. **Mr. W. L. Henderson,** A.M.I.E.E., previously London sales manager, has been appointed southern area sales manager. **Mr. H. Glover** recently took up the position of Midland area sales manager; he was previously with Pyrotenax, Ltd. **Mr. A. H. Sockett,** formerly owner of Southern Electrical Repairs, Ltd., Southampton, will continue as manager of Dowding & Mills, Ltd., Southampton. **Mr. J. Buck,** formerly of Brownings Electric Co., has been appointed technical engineer to the London branch. **Mr. W. E. Halls** has recently taken up the position of south eastern area engineer representative for the London branch, covering mainly Kent, Sussex and S.E. London.

Lord Portal is to be chairman of the newly formed British Aircraft Corporation, which represents the merger of English Electric Aviation, Vickers-Armstrongs (Aircraft) and Bristol Aircraft. There will be two deputy chairmen—**Major-General Sir Charles Dunphie** (chairman of Vickers-Armstrongs (Aircraft)) and **Mr. H. G. Nelson** (chairman of English Electric Aviation). Changes in the board of English Electric Aviation include the retirement from the board of **Lord Nelson of Stafford.** Mr. H. G. Nelson remains chairman of the reconstituted board.

The National Council for Technological Awards has conferred on **Lord Hives,** the Council's first chairman and a former chairman of Rolls Royce, Ltd., an Honorary Diploma in Technology (Engineering).

Mr. W. L. Fraser, C.M.G., has been appointed the first president of Babcock & Wilcox, Ltd. **Sir Kenneth Hague** becomes chairman of the board and **Sir Reginald Verdon Smith** deputy chairman.

The South Western Electricity Board has completed its reorganisation in Cornwall by the setting up of two new and enlarged Districts in the Duchy, thus replacing four former Districts. The former West and Central Cornwall Districts are now merged, as are the North and South Cornwall Districts. Two managerial appointments are announced. They are **Mr. H. R. C. White,** M.I.E.E., M.Amer.I.E.E., to be manager of the new West Cornwall District, and **Mr. H. T. Corrigan,** Associate I.E.E., to be manager of the new Mid-Cornwall District.

Mr. White was chief distribution engineer of the Cornwall Electric Power Co. before nationalisation, and in 1948 he became the sub-area engineer to the South Western Board in Cornwall; in 1950 he was appointed manager of the former West Cornwall District. He was a member of the electricity supply productivity team which visited the United States in 1949.

Mr. Corrigan was appointed assistant electrical engineer with Tiverton Corporation in 1930 and eleven years later became borough electrical engineer and manager. When the industry was nationalised he was appointed manager of the South Western Board's Exe Valley District and in 1959 he was seconded for special duties under the deputy chairman of the Board. The Board's East Cornwall District remains unchanged. The manager is **Mr. F. C. Isaac,** A.M.I.E.E., and the district office is at Liskeard.

Mr. C. J. George, A.M.I.E.E., has been appointed deputy commercial and development adviser to the Electricity Council, in succession to **Mr. R. Y. Sanders,** who retired from his full-time appointment last October. Mr. George received his technical education at Brighton Technical College where, later, he was a part-time lecturer, and gained his early practical training with the Brighton Corporation electricity undertaking. Following war service, he returned to the Brighton undertaking as development engineer and on nationalisation he became assistant commercial engineer in the Mid-Sussex Sub-Area of the South Eastern Electricity Board. He joined the British Electricity Authority in 1952 as senior assistant commercial engineer and later held managerial appointments with the Central Authority. Since the formation of the Electricity Council he has been principal assistant engineer (development) until his present appointment. During the past few years he has been associated with much of the work of

Mr. C. J. George

the Electrical Development Association, has represented the supply industry on a number of outside bodies and he has been a United Kingdom representative in work on supply matters with the Organisation for European Economic Co-operation.

Applications are invited in our advertisement pages today for the position of power station superintendent at Dungeness nuclear power station of the C.E.G.B. The salary offered is £3,000 per annum.

Mr. A. M. Porkess, A.R.C.S.T., A.M.I.Mech.E., has been appointed chief engineer of the National Gas & Oil Engine Co., Ltd., a member of the Hawker Siddeley group. Mr. Porkess was previously chief design and development engineer on medium speed engines for Ruston & Hornsby, Ltd. From 1956 to 1958 he was hon. secretary of the East Midlands Branch of the Institution of Mechanical Engineers.

Mr. A. M. Porkess

Mr. Godfrey Evans, the England and Kent cricketer, has been appointed an executive on the sales staff of Davis & Timmins, Ltd.

Mr. R. L. Fenwick has joined the Technicon Instruments Co., Ltd., as sales manager. He was previously field sales manager with Quickfit & Quartz, Ltd.

Mr. I. G. Maclaren, D.F.C., T.D., has been appointed joint managing director of Robert MacLaren & Co., Ltd., with **Mr. T. G. Richmond,** B.Sc., who also continues as chairman.

The B.B.C. announces the appointment of **Mr. W. E. C. Varley,** Associate I.E.E., A.M.Brit.I.R.E., as superintendent engineer, transmitters, in succession to **Mr. E. F. Wheeler,** O.B.E., D.L.C., M.I.E.E., who retires on 15th June after thirty-six years' service. Mr. Wheeler has been superintendent engineer since 1943. Mr. Varley joined the B.B.C. in 1933 and has been assistant superintendent engineer, transmitters, since 1958.

Mr. M. H. Hall, M.B.E., has been appointed assistant superintendent engineer, London television studios, in succession to **Mr. H. Walker,** O.B.E., A.M.I.E.E., who is retiring after nearly thirty years' service with the B.B.C. Mr. Walker has been with the television service of the B.B.C. since 1931 apart from war service in the R.A.F. and he became assistant superintendent engineer, London television studios in 1953.

Mr. Hall joined the B.B.C. in 1927 and has served with the B.B.C. Television Service since 1936; he was appointed engineer-in-charge of the television studios at Lime Grove in 1950.

Mr. W. D. Hatcher, B.Sc.(Eng.), A.M.Brit.I.R.E., will succeed Mr. Hall as engineer-in-charge, London television studios. He has been with the B.B.C. since 1931 and has been assistant engineer-in-charge of the Lime Grove television studios since 1950.

Mr. L. B. Pearson, A.M.Inst.F., deputy station superintendent, Tilbury generating station, Eastern Division, C.E.G.B., has been appointed station superintendent as from 1st June.

At the recent annual conference of the Electrical Contractors' Association of Scotland held at the Glenburn Hotel, Rothesay, **Mr. J. Y. Dick,** of Oliver Melville & Co., Kirkcaldy, was re-elected president for the ensuing year. **Mr. Alec Robertson,** electrical contractor, Glasgow, was also elected vice-president for a second term.

Mr. A. V. Williams, B.Sc., A.C.G.I., A.M.I.E.E., A.M.I.Prod.E., has been appointed to the board of Line Equipment, Ltd., as works director. He will continue as chief electrical engineer to the company, a position which he has held for the past six years.

The Engineering Group of the General Electric Co., Ltd., has appointed **Mr. J. L. Orme,** A.M.I.E.E., as deputy chief engineer for the London, Eastern, and Southern areas, for which Mr. E. W. Molesworth was recently appointed chief engineer. Mr. Orme was educated at Trent College, and after joining the G.E.C. as an apprentice in 1920, he was nominated by the company for a scholarship at Birmingham University. He returned to the Witton Works and later spent three years as assistant branch engineer at the company's Cardiff branch. In 1928 he moved to the head office and later was appointed chief assistant to the manager of the Central Stations Department, Mr. G. H. Mann, who retired last January. Although in his new appointment Mr. Orme will be associated with all the engineering activities of the company, his main interest will still be in the supply industry.

Mr. J. L. Orme

The Minister of Power has appointed **Sir Kenneth Preston** as a part-time member of the South Eastern Electricity Board. **Ald. W. J. English,** M.B.E., J.P., of Yeovil, Somerset, has been appointed a part-time member of the South Western Electricity Board.

Mr. W. F. Lawrence has been appointed sales supervisor for Southampton Electrical Distributors, Ltd., a member of the CEDCO group of companies. Mr. Lawrence was previously branch manager with Enfield Cables, Ltd., at Southampton.

A.E.I.-Hotpoint, Ltd., announce the following appointments, effective 1st June:—**Mr. A. W. P. Stephen,** B.Sc.(Eng.), A.M.I.E.E., A.M.I.Prod.E., has been appointed general design manager; **Mr. J. B. Smith** has been appointed general marketing manager; **Mr. D. B. Hunt,** A.C.W.A., becomes chief accountant; **Mr. H. W. Thompson** has been appointed industrial sales manager; **Mr. J. W. Kitson,** A.M.I.E.E., is appointed manufacturing manager, A.E.I.-Gala, Ltd. (the export company of the Hotpoint Group); **Mr. C. M. O. Jones** has been appointed marketing manager, home laundry; **Mr. N. C. B. Abbott** becomes marketing manager, refrigerators; **Mr. B. Healey** has been appointed marketing manager, sheathed wire and special projects; and **Mr. J. S. Kerridge** has been appointed marketing manager, portable appliances.

Mr. H. E. R. Shand, C.A., has been appointed to the board of Mullard, Ltd., in succession to **Mr. A. W. Welton,** C.A., who retired on 30th April last.

Mr. J. J. Hill, B.Sc., A.M.I.E.E., a member of the research staff at the National Physical Laboratory, has accepted an invitation from the U.S.S.R. Academy of Sciences for a fortnight's lecture tour in the Soviet Union and he left London by air on 1st June. The subjects of his lectures will be "Precise Audio-frequency Power Measurements" and "The Design Aspects of Wide Range Precision Transformers."

Horace Green & Co., Ltd., celebrated their golden jubilee on 7th May when employees were guests of the company on a day trip to Dublin. They were taken by special coaches to Yeadon Airport and transported to Dublin by chartered aircraft. A tour of the city in special coaches had been arranged and then a drive along the coast to Bray for lunch. After spending a short time in Bray the party returned to Dublin for tea. Later in the evening they returned by air, supper being served at the airport restaurant.

The winner of the Osram Cup for 1960, presented by the **General Electric Co., Ltd.,** to the overall winner in the Royal Aero Club's business and touring aircraft competition, held at Shoreham Airport on 20th and 21st May, was Mr. M. D. Parry, flying a Helio Courier. The trophy was presented by Air Commodore A. H. Wheeler, C.B.E., chairman of the R.Ae.C.'s Racing and Records Committee.

OBITUARY

Mr. C. H. Frankland, M.I.E.E., a director of British Insulated Callender's Construction Co., Ltd., from its formation in 1949 until his retirement in September last, died on 19th May at the age of sixty-five. He joined Callender's Cable & Construction Co. in 1910 and served in the Forces in the 1914-18 war. He rejoined the company in 1919 and was appointed London district contracts engineer in 1929. From 1942 to 1946 he was manager, power cable contracts, and upon the amalgamation of the B.I. and Callender companies became manager, power and telephone cable contracts, in the B.I.C.C. organisation.

The late Mr. L. F. Jeffrey

Mr. L. F. Jeffrey, B.Sc.(Eng.), M.I.C.E., M.I.Mech.E., M.I.E.E., former divisional controller of the East Midlands Division of the C.E.G.B., whose death we briefly reported in our last issue, joined the Birmingham Electric Supply Department in 1925 as assistant design and constructional engineer and eleven years later was appointed technical assistant and constructional engineer to the West Midlands Joint Electricity Authority, of which he became deputy chief engineer in 1938 and chief engineer in 1942. On nationalisation he was appointed chief generation engineer (construction) of the British Electricity Authority's Midlands Division, going to Nottingham as divisional controller of the East Midlands Division in 1951, a post which he held until ill-health forced him to retire six months after the formation of the C.E.G.B. Mr. Jeffrey had wide experience in the design, construction, operation and maintenance of power stations. He was appointed a member of the National Committee on Standardisation of Turbo-Alternators in 1945 and in 1947 became a member of the District Consultative Technical Committee for Central England set up by the Central Electricity Board. In the same year he visited America to study technical schemes of a number of undertakings.

WILLS

Mr. E. M. Packham, secretary of the Eastern, London and South Eastern Region of the C.E.G.B., who died on 7th October last, left £9,883 gross (£9,692 net).

Mr. L. B. Jones, joint managing director of Radio & Allied Industries, Ltd., who died on 22nd August last, left £117,859 gross (£110,960 net).

Mr. H. K. Rodwell, formerly of the Metropolitan-Vickers Electrical Co., Ltd., who died on 19th July last, left £39,590 gross (£39,427 net).

Mr. C. W. Thompson, vice-chairman of the Beds. and Herts. Branch of the Electrical Contractors' Association, who died on 29th August last, left £10,416 gross (£10,357 net).

ELECTRICITY IN HOUSING

THE demand for better standards of heating is brought out in two further replies to the questionnaire circulated by the Sub-Committee on Housing Standards of the Central Housing Advisory Committee of the Ministry of Housing and Local Government.

The Association of Electric Housecraft Advisers believe that whole-house comfort heating is the aim of a rapidly increasing proportion of the public, and, they state, much "expensive additional wiring is being done by householders and tenants to enable the use of heaters in hitherto unheated rooms and passages, as well as to increase comfort in living rooms already containing heating facilities." The Association consider electric floor warming, with additional occasional heating, to be the central heating of the future. In the meantime they point to the economies obtained by using room thermostats and time switches.

Kitchens are criticised as being too small and it is recommended that the wall space should allow equipment to be placed in sequence. The Association do not favour kitchens in which all the electrical equipment is provided and, they state, freedom of choice and future expansion should not be compromised by too rigid planning of the space. The Association recommend four to six socket-outlets in the living room and the same number in the bedrooms or bed-sitting rooms; six to eight, plus the cooker unit, in the kitchen; two or three in the utility room; two in the circulation space on each floor; and one in the loft. There should also be one or two permanent connections in the bathroom. Some socket-outlets should be at working level. Each room needs good general lighting backed by local lights according to its use. The contribution which adequate wiring and lighting make to safety are also mentioned.

In their evidence the Town and Country Planning Association say "there should be at least two electrical points in each living room; two in the kitchen in addition to any electric cooker point; two in each double and one in each single bedroom; one in the airing cupboard; one in the hall and one on the landing." There should be an electric ceiling light in each room and in the larder, and at least one gas point in the kitchen and one in at least one of the living rooms.

On heating, the Association state: "We think there are firm indications of a trend towards partial or complete central heating, but some people will continue to want the open fire in the main living room. More people are willing to pay extra for power heating to avoid the mess and bother of direct solid fuel heating." The Association say that the use of immersion heaters as an alternative form of water heating is increasing rapidly, and the fitting and operation of this equipment should be made as simple as possible.

Electric Floor Warming

A new six-page leaflet (ref. TE11) giving full details of their embedded system of floor heating has been produced by Tyrad Electric, Ltd., Imperial Court, Basil Street, Knightsbridge, London, S.W.3. Calculations, technical data and prices are sufficient to enable a contractor to plan a complete installation. Also announced is a new former for retaining the heating cables in position during installation. This is made from extended T-section p.v.c. and is slotted at intervals to take the heating cables. It can be removed after installation of the wires and re-used.

INDUSTRIAL NEWS

European Trade Talks

Faced with the prospect of an accelerating Common Market, and its growing political and commercial solidarity, British policy on future relations with the European Economic Community has apparently been going through a welcome period of reappraisal. Joining Euratom or the Coal and Steel Community or both have been thought of as possible preliminaries to closer ties with, if not eventual membership of, the Common Market.

In the meantime the European Free Trade Area Council at their meeting in Lisbon reaffirmed their view that any association with the Common Market must be as a group. Their attitude is, however, now markedly more flexible and it looks as though the seven E.F.T.A. countries would now be prepared to negotiate with the Common Market on the basis of a Customs Union. It is recognised that the preferred Free Trade Area incorporating both groups is no longer feasible. An important condition of the Seven joining a European Customs Union would be that the level of tariffs would have to be low. This might be a preliminary to a European initiative to get tariffs reduced on a world-wide basis.

Unfortunately the chances of promoting this desirable long-term aim may be compromised by the anxiety of the Seven for a more immediate solution. At the talks which are to be held in Paris on 9th June, the Common Market countries have stated that they are only prepared to discuss ways of modifying the impact of their accelerated Common Tariff through reductions on a most favoured nation basis. Nevertheless, in agreeing to talk about immediate problems both sides appear to be taking a constructive attitude. More far reaching negotiations will depend on a basic change in Britain's political approach.

E.F.T.A. Rates of Duty

A Treasury order published last week (Import Duties (European Free Trade Association) Order, 1960, H.M. Stationery Office, price 3d) introduces on 1st July the first instalment of the tariff reductions that result from the United Kingdom's membership of the E.F.T.A. For most of the products affected by the reductions the E.F.T.A. rates of duty will be four-fifths of the full rates charged at present. Consequent amendments to the drawback duty are covered by Import Duty Drawback (No. 7) Order, 1960 (H.M. Stationery Office, price 3d).

Diesel-Electric Locomotive Equipment Order

Crompton Parkinson, Ltd., has received an order for ninety-eight sets of 1,550 h.p. Type 3 diesel-electric locomotive equipment for the Birmingham Railway Carriage & Wagon Co., Ltd., the locomotives being for use on British Railways, Southern Region. The design of the Type 3 equipment includes provision for electric train-heating, applied to diesel locomotives for the first time in this country. Compared with Type 2, a larger and more powerful Sulzer diesel engine is fitted in the space saved by the elimination of the steam boiler and water tanks and this drives a Crompton Parkinson generator set which provides electricity not only for traction but also for heating and auxiliaries. The main generator is rated at 1,012 kW at 750 r.p.m. The main, train-heating and auxiliary armatures are mounted on a common steel rotor, with the train-heating generator at the engine end of the main frame.

The four series-wound traction motors are operated in parallel across the main generator. They have a continuous rating of 305 h.p. 440 A 580 V and drive the axles through resilient gears.

Radioactive Wastes

The release of highly radioactive wastes into the sea cannot at present be recommended as an operational practice, but the sea disposal of wastes of low and intermediate activity may be safe under controlled and specified conditions. This is one of the conclusions reached by an international panel of experts set up by the Director General of the International Atomic Energy Agency. The panel, whose report was issued in Vienna on 31st May, has recommended that all radioactive wastes disposed of into the sea, with the exception of those incidental to the operation of nuclear-powered ships, should be released into designated disposal sites in conformity with conditions specified for the particular site. Wastes from nuclear ships should be released in such a way as not to limit the harvest of marine products. Further, each disposal site should be designated by a responsible national or international authority which should also set out the conditions of disposal for the site. It should also provide for any necessary monitoring of the area to verify that safe conditions are maintained and collect disposal records that would adequately indicate the state of the site.

Another important recommendation of the panel is that all authorities setting up disposal sites should supply a suitable international authority with information necessary to maintain an adequate register of waste disposals into the sea. In the opinion of the panel, this register should be maintained by the I.A.E.A., which should also provide for any necessary standardisation of monitoring techniques.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton £180 0s 0d
COPPER, H.C. Electro	ton £238 5s 0d
Fire Refined 99·70%	ton £237 0s 0d
Fire Refined 99·50%	ton £236 0s 0d
COPPER Tubes ..	lb 2s 4d
Sheet	ton £270 15s 0d
H.C. wire and strip ..	ton £288 15s 0d
LEAD, English ..	ton £75 15s 0d
Foreign	ton £74 0s 0d
MERCURY	flask £72 0s 0d
TIN, block (English) ..	ton £781 10s 0d
ZINC, G.O.B. Foreign	ton £91 5s 6d
BRASS Tubes (solid drawn)	lb 1s 11⅜d
Wire	lb 2s 9d
PHOSPHOR BRONZE Wire	lb 4s 2d
PLATINUM	oz £28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb 38⅜d—38⅝d

Import Duty Drawbacks Order

The Treasury has made the Import Duty Drawbacks (No. 6) Order, 1960, which extends the scope of existing provisions whereby drawback is allowed on certain insulator caps, and microphones and earphones for deaf-aids. The Order (Statutory Instruments 1960, No. 906) came into operation on 31st May.

Induction Furnace Agreement

An agreement signed between the General Electric Co., Ltd., and the British-Geco Engineering Co., Ltd., of Edenbridge, Kent, covers the design, manufacture and sale of induction furnaces such that the resources and expert knowledge of the two companies in all matters relating to induction heating are combined. The types include melting equipment, billet heating equipment, soldering and brazing machines, local heat treatment plant and stress-relieving equipment. Inquiries for induction heating plant covered by the agreement should be addressed to the Furnace Department, General Electric Co., Ltd., Erith, Kent.

Automation Company

At a luncheon given in London on 20th May, Mr. L. Bagrit, chairman of Elliott-Automation, Ltd., gave details of a new company being formed within the Elliott group. Devoted to the field of pure automation, the company, E.A. Automation Systems, Ltd., will make extensive use of the most modern developments from both this country and overseas in this aspect of engineering. One of its objects will be to advise on industrial automation problems and it is at present studying a large project for automatic plant in Europe. Members of the board of the new company, which has absorbed the Systems Group of the parent company, are Dr. L. Ross, Mr. M. V. Needham and Mr. G. Fairbanks.

Sales Conference

The Cambridge Instrument Co. recently held its annual sales conference when agents' representatives from as far afield as Australia, Canada and India, as well as from most Western European countries, attended. During the conference the representatives visited the Cambridge and Muswell Hill Works and the mechanical thermometer division at Finchley. The conference ended with a dinner at the Hotel Rembrandt, London.

Semiconductor Device Manufacture

Last week the new semiconductor factory of the International Rectifier Co. (Great Britain), Ltd., was officially opened by Sir John Vaughan-Morgan, M.P. This company, formed just over a year ago, is owned jointly by the International Rectifier Corporation of El Segundo, California, and Metal Industries, Ltd. A novel feature of the opening ceremony was that a solar cell was employed to operate a relay which released a ribbon across the door leading to the factory area. This solar cell was of a similar type to that recently produced by the American company to provide the necessary power for the American weather-eye satellite.

The Oxted factory has been designed specifically to meet the stringent needs of semiconductor device manufacture. The silicon area is completely pressurised and fed with filtered air, the materials section being supplied by an independent system. Visitors attending the opening ceremony had the opportunity of seeing silicon diodes in the course of manufacture. The first stage here is the growing of the crystal; for this the Czockralsky method is employed. Silicon pure to one part in a thousand million is melted in an electric furnace at over 1,400°C, and the crystal growth is initiated by touching the molten silicon with a seed crystal which is then withdrawn at a predetermined rate. The conductivity of the resulting crystal is determined at this stage by additions of known impurities to the molten silicon. After this, the crystal characteristics are measured and the crystal is cut into thin slices. These are passed to the main assembly area, where the first operation is alloying, which is effected by passing the assembly of the diode component parts in a suitable jig through a tunnel oven, the temperature of which is accurately controlled. Here the junction is produced which determines the electrical characteristics of the finished diode.

The junctions are then given special surface treatment; they have their first electrical testing, and are then hermetically sealed against any contamination. Finally comes the stringent testing, both electrical and mechanical, under extreme environmental conditions.

The new fluorescent lighting fittings showroom of E. J. Schofield & Co., Ltd., Manchester

Anglo-French Collaboration in Electronics

The formation of M.C.P. Electronics, Ltd., under the joint management of Mining & Chemical Products, Ltd., and the semiconductor division of the Compagnie Française Thomson-Houston is announced. The new subsidiary is about to produce gold-bonded germanium diodes on a large scale. At the same time it is marketing in this country the full range of transistors, diodes, and rectifiers produced by the Compagnie Française Thomson-Houston in France.

Fluorescent Lighting Fittings Showroom

E. J. Schofield & Co., Ltd., 61, Bridge Street, Manchester, 3, has recently opened a showroom devoted to the display of its "Moorlite" fluorescent lighting units, a view of which is reproduced. The company has also issued a well-produced catalogue of its industrial and commercial fluorescent lighting fittings. Many of the illustrations are in full colour.

Cabling of Portsmouth Dockyard

Pirelli-General Cable Works, Ltd., has been awarded a contract by the Admiralty for the supply, installation and jointing of some 4,700 yd of land cable and approximately 8,500 yd of submarine cable together with 5,500 yd of combined pilot and telephone cables. The 33 kV 3-core 0·3 sq in oil-filled cables will be laid between Portsmouth Dockyard and a Gosport substation. The submarine cable will be laid across Portsmouth Harbour. These cables will ensure an alternative source of high voltage supply to the Dockyard.

Price Reductions

Luxram Electric, Ltd., has reduced the prices of its range of 2,000 hr double life lamps. The new prices are:—40 W and 60 W, 1s 10d; 75 W and 100 W, 2s 1½d; 150 W, 4s; and 200 W, 5s 2d. All prices include purchase tax.

Batti-Wallahs' Society

The guest speaker at last week's luncheon of the Batti-Wallahs' Society was Mr. H. F. P. Harris, author and politician, whose entertaining address was on "Acceptance or Curiosity," in the course of which he spoke of the general tendency today to tacitly accept views expressed by others rather than to inquire into their reasons. Mr. J. S. Bunting (president) was in the chair, and Mr. J. Temple Hazell (immediate past-president) proposed the vote of thanks. Mr. H. E. Fleetham (the "Mate") announced that the next luncheon would be on Wednesday, 29th June, when the speaker would be Mr. G. Johnson Smith, M.P., who would talk on "Parliamentary Impressions."

Trade Announcements

Ekco Heating (**E. K. Cole, Ltd.**), London, W.1, announces the appointment of Mr. G. South as general sales representative for Yorkshire and the North-East Coast area. He joins Ekco from Burco.

Aveley Electric, Ltd., has secured the agency in the United Kingdom for all products of the Allen B. Du Mont Laboratories Inc., U.S.A., which include oscilloscopes, oscilloscope recording cameras, and special purpose cathode tubes and photo-multiplier.

Royce Electric Furnaces, Ltd., has moved to a new factory at Albert Drive, Sheerwater, Woking, Surrey (telephone: Woking 5401-4).

The **Elgar Machine Tool Co., Ltd.,** has been appointed the exclusive distributor in the United Kingdom for the range of vertical and horizontal injection moulding machines manufactured by its principals, P. Flesch, Ludenscheid, Germany.

Considerable extensions, increasing the total floor space by approximately 40 per cent, have recently been completed at the Glasgow branch of **Wolf Electric Tools, Ltd.,** at Strathcona Street, Scotstoun. The branch is now under the management of Mr. A. Stringer, who before this appointment was for several years at the London head office.

Dowding & Mills, Ltd., announce that they have acquired the business of Southern Electrical Repairs, Ltd., 55, Millbrook Road, Southampton, as from 1st June. Mr. A. H. Sockett, formerly owner of Southern Electrical Repairs, Ltd., is to continue as Southampton manager for Dowding & Mills, Ltd., and the general administration will be centred on the London branch, 24, White Post Lane, Hackney, E.9, under the management of Mr. P. L. Hollings.

Three new appointments are announced by the South-East Region of **Philips Electrical, Ltd.** Mr. R. C. Mercer has been appointed manager of the Regional Street Lighting Department, Mr. R. Pitteway succeeds him as area manager, and Mr. D. I. Campbell, B.Sc.(Econ.), replaces Mr. Langworthy, who recently retired, as lamp and lighting representative for Bedfordshire, Cambridgeshire and Huntingdonshire.

Morphy-Richards, Ltd., the holding company of the Morphy-Richards group of companies, announces that its offices are now at 50, Conduit Street, London, W.1.

The **Cambridge Instrument Co., Ltd.,** has moved its Nottingham office to Century Insurance Building, Milton Street, Nottingham (telephone: 42612).

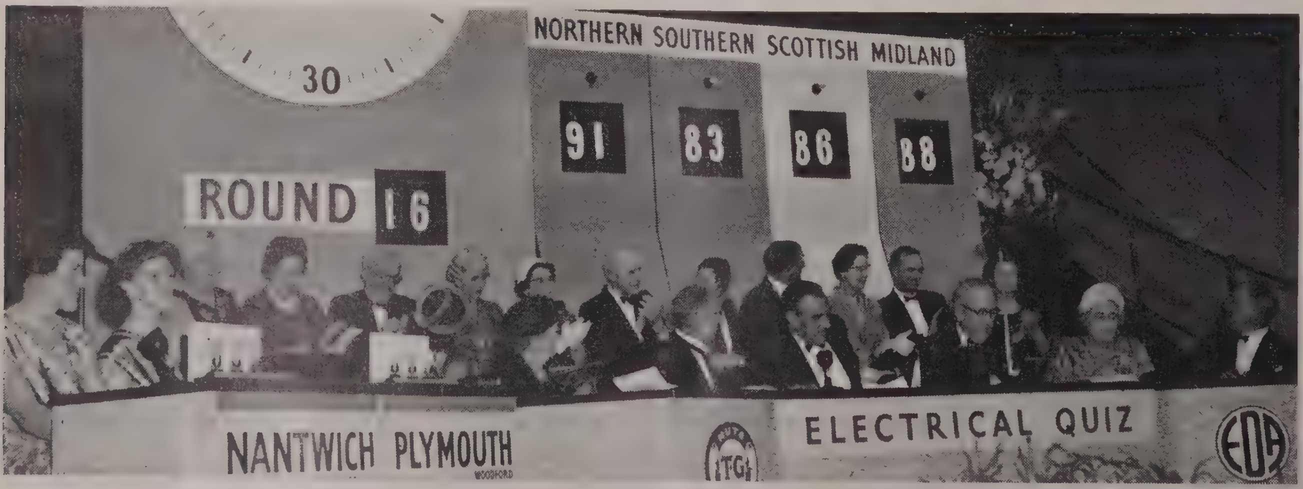
The London address of **Permanoid, Ltd.,** is now 17-21, Emerald Street, W.C.1 (telephone: Chancery 6543/4).

E.D.A. Electricity "Quiz"

THE national final of the electricity "quiz" competition organised on behalf of the National Union of Townswomen's Guilds by the British Electrical Development Association took place at the Royal Albert Hall, London, last week. The four final teams, survivors of an original entry of over 1,000, provided a contest which was not only exciting but at all times informative and full of interest. The winning team was the Nantwich Guild, representing the North, who scored 91 out of a possible total of 96 marks. Runners-up were the Midlands, represented by Wellingborough Finedon Guild (88); Scotland, Keith Guild (86), and South, Woodford Plymouth Guild (83), were third and fourth respectively.

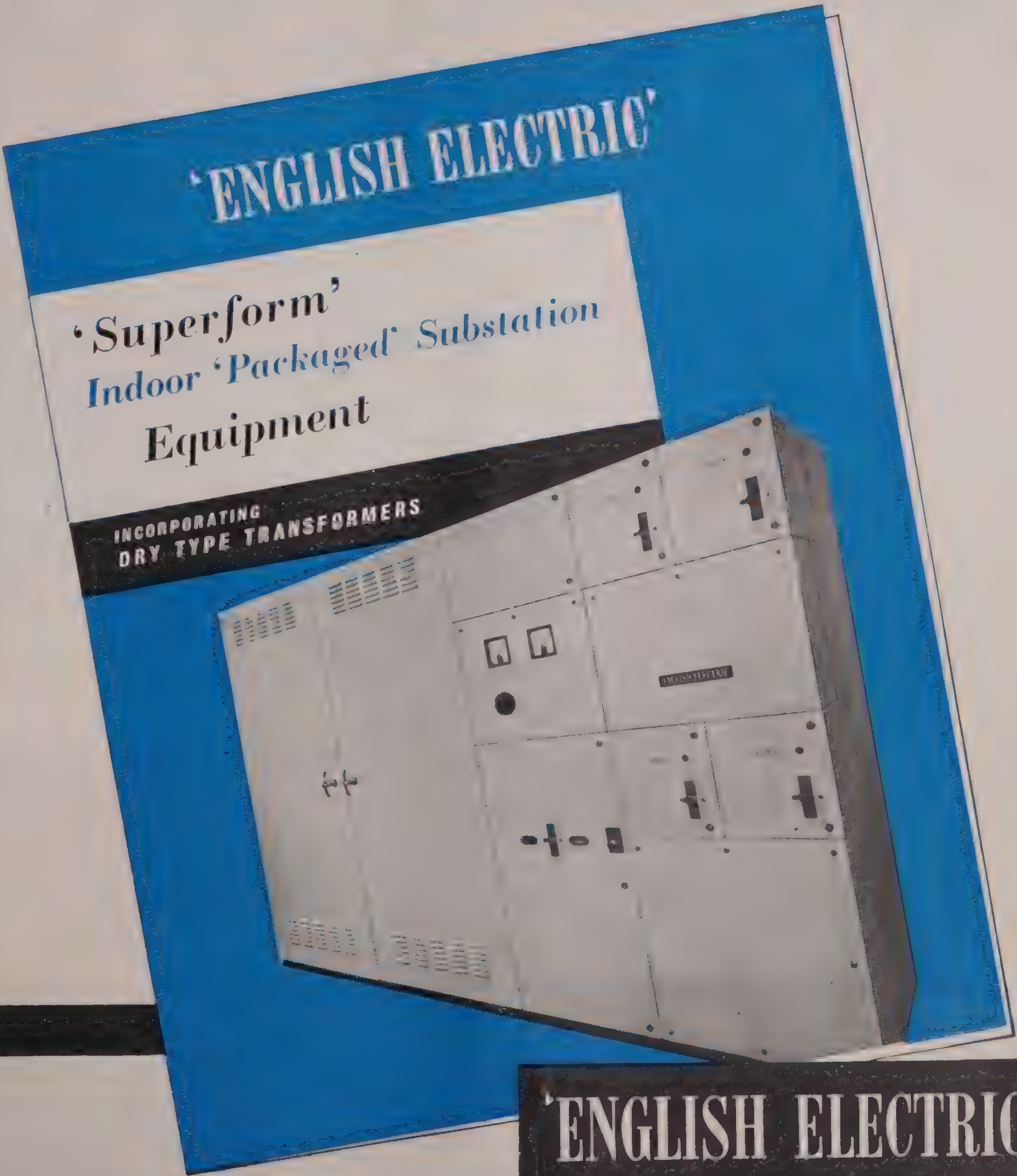
The "quiz," which was presided over by Sir Edwin Herbert, president, E.D.A., was conducted by Mr. Franklin Engelmann and compèred by Mr. Peter West. Mr. J. I. Bernard, director and secretary, E.D.A., acted as technical adviser.

Lady Dorothy Macmillan presented the prizes and each member of the winning team received a refrigerator. The runners-up were awarded tumbler dryers and the remaining competitors each received either a rotary spit or an electric heater. Altogether about 4,000 people were present, mostly members of the N.U.T.G., and the platform party included several notable Electricity Board personalities. Among those present were Mr. D. B. Irving (chairman of E.D.A. and chairman, London Electricity Board); Mr. R. R. B. Brown (vice-chairman of E.D.A. and chairman, Southern Electricity Board); Mr. N. Marsh (chairman, East Midlands Board); Mr. C. T. Melling (member, Electricity Council); and Mr. W. N. C. Clinch (controller, Eastern Division, C.E.G.B.).



In this view of the platform at the conclusion of the electricity "quiz" contest, the final scores and positions of the teams can be seen

what is a 'Packaged' Substation ?



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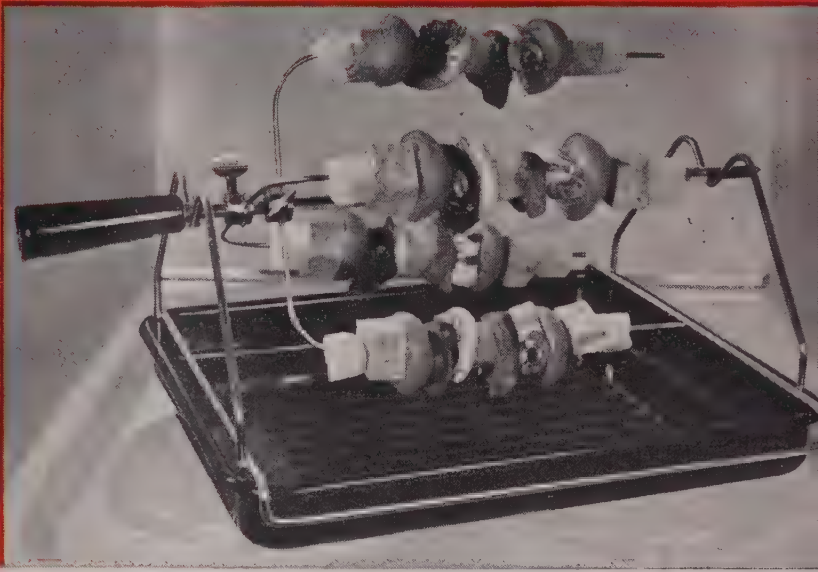

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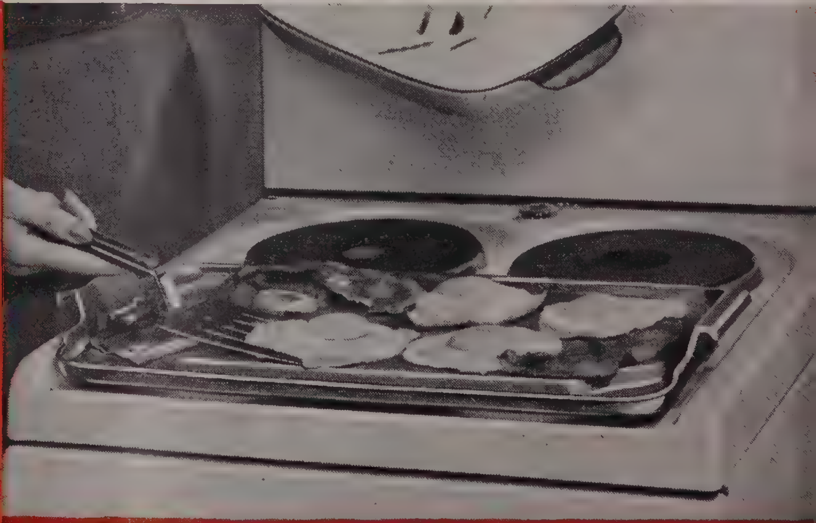
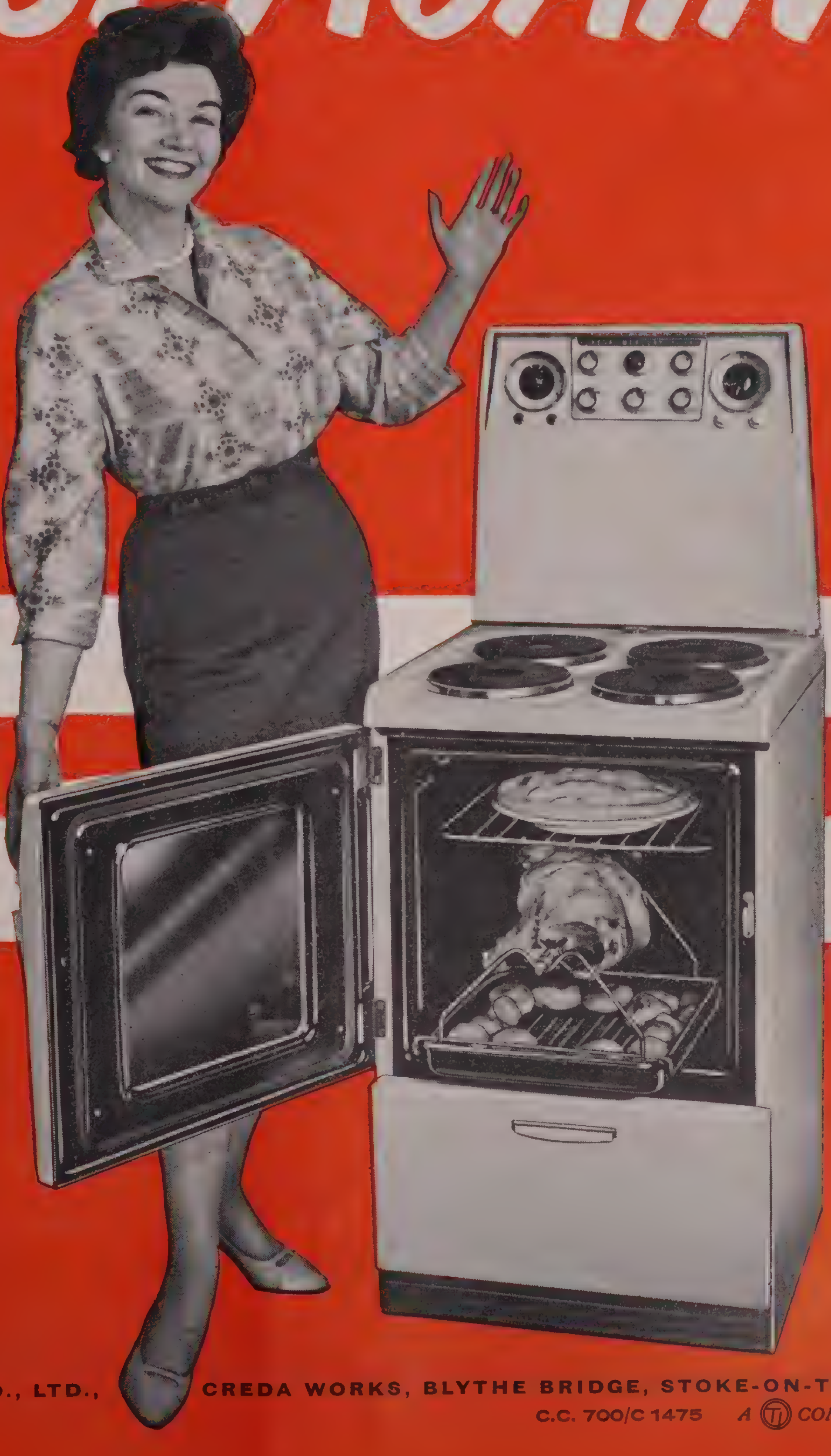


FIRST AGAIN



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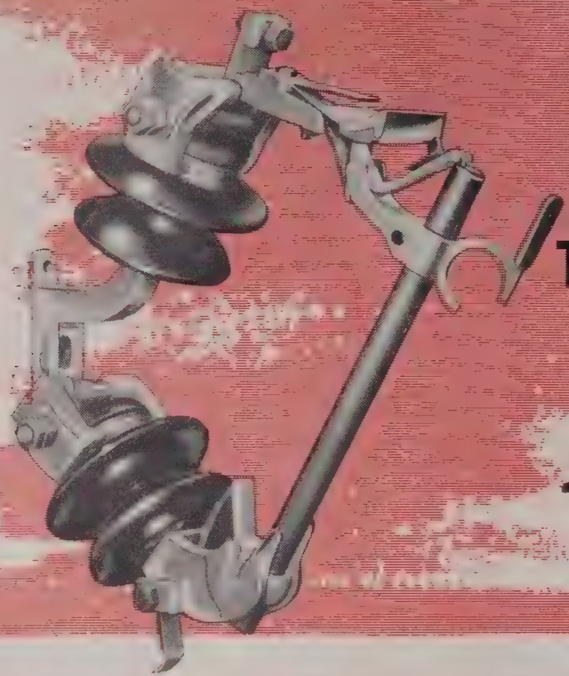

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DOMESTIC ELECTRICAL EQUIPMENT

THERMAL STORAGE WATER HEATERS

THE provision of hot water electrically can be accomplished in several ways and for a constant supply a most popular method is by means of a self-contained, or thermal storage, water heater. Several types of heater in this form are available, ranging in size from the 1½ to 3 gal sink models to the larger 20 and 30 gal heaters suitable for supplying the complete hot water needs of a household.

The running costs of electric water heaters compare favourably with those of other forms of water heating—waste of electricity is prevented because of their efficient lagging and the fact that all models are thermostatically controlled. The smaller water heaters, or non-pressure types, are designed to deliver hot water at one point and may be connected to the mains-fed cold water supply or supplied from a cistern. Pressure type heaters, however, designed to supply hot water to a number of taps must never be directly connected to a mains water supply. Where there is no cistern, use can be made of the cistern type water heaters, which have their own built-in tanks. These can, of course, be fed direct from the mains, but they must be installed higher than the taps to be served.

The majority of sink water heaters are fitted with either 1 or 1½ kW heating elements and when hot water is drawn off the replacement rate is approximately half-a-gallon every ten minutes. The Heatrae "Lido Express" model, however, is fitted with either a 2 or 3 kW element and, with the higher loading, it is claimed that up to 9 gal of hot water an hour can be continuously provided. A new water heater, introduced only last month, is the Modern Equipment Co.'s "Sincomatic," a 2 gal non-pressure model of unusual design available in a choice of coloured finishes.

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
AIDAS ELECTRIC, LTD., **Sadia Works,** **Rowdell Road,** **Northolt,** **Greenford,** **Middlesex.**	G	Wall mounting, free outlet	1½ gal	750 W	White with blue bands	£10 10 0	£2 1 0
	" Two-Plus "	Wall mounting, free outlet	2·2 gal	1 kW	Various colours with chromium mouldings	£10 10 0	£2 1 0
	H	Wall mounting, free outlet	3 gal	1 kW	White with blue bands	£12 0 0	£2 6 10
	" Select "	Rectangular wall mounting free outlet	3 gal	1 kW	Various colours with chromium mouldings	£13 10 0	£2 12 8
	U.T.C.	Wall mounting, pressure	3 gal	1½ kW	White or cream with coloured bands	£12 12 0	£2 9 2
	U.T.C.	Floor mounting, pressure	3 gal	1½ kW	White or cream with coloured bands	£13 2 0	£2 11 2
	B	Wall mounting, free outlet (A) or pressure (B)	5 gal	1 kW	White or cream with coloured bands	£17 0 0 (A) £16 0 0 (B)	£3 6 4 (A) £3 2 5 (B)
	L	Wall mounting, free outlet (A) or pressure (B)	7½ gal	1 kW	White or cream with coloured bands	£19 0 0 (A) £18 0 0 (B)	£3 14 2 (A) £3 10 3 (B)
	C	Wall mounting, free outlet (A) or pressure (B)	12 gal	1 or 1½ kW	White or cream with coloured bands	£23 10 0 (A) £22 10 0 (B)	£4 11 8 (A) £4 7 9 (B)
	D	Wall mounting, free outlet (A) or pressure (B)	15 gal	1½ kW	White or cream with coloured bands	£26 10 0 (A) £25 10 0 (B)	£5 3 5 (A) £4 19 6 (B)
	U.D.B.–20	Floor mounting, pressure (A) or wall mounting, pressure (B)	20 gal	1 kW plus 2 kW	White with blue bands	£29 0 0 (A) £29 15 0 (B)	£5 13 2 (A) £5 16 1 (B)
	U.D.B.–30	Floor mounting, pressure (A) or wall mounting, pressure (B)	30 gal	1 kW plus 2 kW	White with blue bands	£34 10 0 (A) £35 5 0 (B)	£6 14 7 (A) £6 17 6 (B)
	I.S.	Floor mounting, pressure	40 gal	3 kW and 6 kW	White with blue bands	£52 10 0 (3 kW) £60 0 0 (6 kW)	£10 4 9 (3 kW) £11 14 0 (6 kW)
	B.B.T.	Wall mounting, cistern	5 gal	1 kW	White or cream with coloured bands	£22 0 0	£4 5 10
	L.B.T.	Wall mounting, cistern	7½ gal	1 kW	White or cream with coloured bands	£25 0 0	£4 17 6

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
AIDAS ELECTRIC, LTD., Sadia Works, Rowdell Road, Northolt, Greenford, Middlesex *(continued)*	C.B.T.	Wall mounting, cistern	12 gal	1 or 1½ kW	White or cream with coloured bands	£28 0 0	£5 9 3
	D.B.T.	Wall mounting, cistern	15 gal	1½ kW	White or cream with coloured bands	£31 0 0	£6 0 11
	U.D.B./B.T.	Wall mounting or floor mounting, cistern	20 gal	2 or 3 kW	White with blue bands	£34 0 0	£6 12 8
	U.D.B./B.T.	Wall mounting or floor mounting, cistern	30 gal	2 or 3 kW	White with blue bands	£39 0 0	£7 12 2
BERRY'S ELECTRIC, LTD., Touchbutton House, Newman Street, London, W.1.	A.Q./3	Sink or basin	3 gal	1 or 2 kW	Green, blue, white or cream, chromium fittings	£11 19 4 (1 kW) £12 9 4 (2 kW)	£2 6 8 (1 kW) £2 8 8 (2 kW)
	A.Q./1½	Sink or basin	1½ gal	1 kW	Green, blue, white or cream, chromium fittings	£10 17 7	£2 2 5
CREDA (SIMPLEX ELECTRIC, LTD.), Blythe Bridge, Stoke-on-Trent, Staffs.	C142	Single-point wall mounting	3 gal	1 kW	White or cream. Pastel shades extra	£11 19 6	£2 6 8
	"Crusader" C143		3 gal	2 kW	White or cream. Pastel shades extra	£11 19 6	£2 6 8
	C5SP		5 gal	1·2 kW	White	£18 10 0	£3 15 1
	C12SP		12 gal	2 kW	White	£26 15 0	£5 4 4
	C20SP		20 gal	2 kW	White	£31 10 0	£6 2 10
	C5MP	Multi-point wall mounting	5 gal	1·2 kW	White	£17 0 0	£3 9 7
	C12MP		12 gal	2 kW	White	£23 5 0	£4 10 8
	C20MP		20 gal	2 kW	White	£28 0 0	£5 9 2
	"Centrepoint"	Multi-point floor mounting	20 gal	3 kW	White or cream. Pastel shades extra	£27 0 0	£5 5 4
	C20MPF		20 gal	2 kW	White	£42 0 0	£8 3 10
	C30MPF		30 gal	3 kW	White	£51 10 0	£10 0 10
	C5BR	Cistern, rectangular wall mounting	5 gal	1·2 kW	White	£26 0 0	£5 1 5
	C7BR		7½ gal	1·2 kW	White	£29 0 0	£5 13 1
	C12BR		12 gal	2 kW	White	£33 0 0	£6 8 9
	C15BR		15 gal	2 kW	White	£39 0 0	£7 12 1
	C20BR		20 gal	2 kW	White	£41 0 0	£7 19 11
	C5BC	Cistern, cylindrical wall mounting	5 gal	1·2 kW	White	£24 0 0	£4 13 7
	C12BC		12 gal	2 kW	White	£30 0 0	£5 17 0
	C15BC		15 gal	2 kW	White	£33 0 0	£6 8 8
	C20BC		20 gal	2 kW	White	£34 10 0	£6 14 7
	C20BCF	Cistern, cylindrical floor mounting	20 gal	2 kW	White	£52 0 0	£10 2 10
	C30BCF		30 gal	3 kW	White	£60 0 0	£11 14 0
ELTRON (LONDON), LTD., Accrington Works, Strathmore Road, Croydon, Surrey.	S.N.3	Small. Non-pressure under basin	¾ gal	1 kW	White enamel	£11 3 0	£2 1 10
	E.B.5	Overflow wall mounting	1½ gal	2 kW	White enamel	£14 10 0	£2 14 4
	S.N.L.15	Under sink kitchen unit heater	3½ gal	2 kW	White enamel	£32 10 0	£6 1 10
GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.	"Superspeed" Double-two D.E.602	Non-pressure (single-point)	2 gal	1·2 kW or 2 kW	White stoved enamel or honeysuckle. Choice of coloured bands	£11 10 0	£2 4 10
	DE.605	Non-pressure (single-point)	5 gal	2 kW	White stoved enamel	£19 5 0	£3 15 1
	DE.610	Non-pressure (single-point)	12 gal	2 kW	White stoved enamel	£26 15 0	£5 4 4
	DE.615	Pressure (multi-point)	15 gal	2 kW	White stoved enamel	£25 10 0	£4 19 5
	DE.630	Pressure (multi-point)	30 gal	3 kW	White stoved enamel	£47 10 0	£9 5 3
	DE.690	Pressure (multi-point)	20 gal	3 kW	White stoved enamel	£35 10 0	£6 18 5
	DE.626	Cistern	15 gal	1½ kW	White stoved enamel	£39 0 0	£7 12 1
	DE.627	Cistern	20 gal	2 kW	White stoved enamel	£41 0 0	£7 19 11

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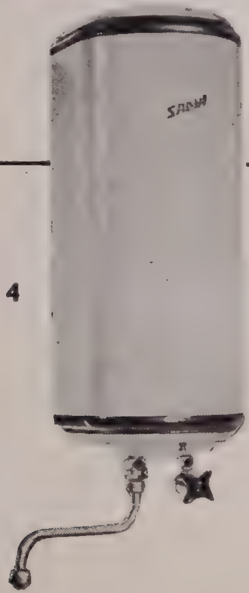
1. G.E.C. "Superspeed Double-Two" 2 gal heater
2. Simplex "Crusader" model C.143
3. G.E.C. model DE.690 dual heat floor standing heater
4. Aidas "Two-Plus" 2·2 gal water heater
5. Berry's model AQ/3 3 gal water heater
6. Heatrae "Lido Express" water heater



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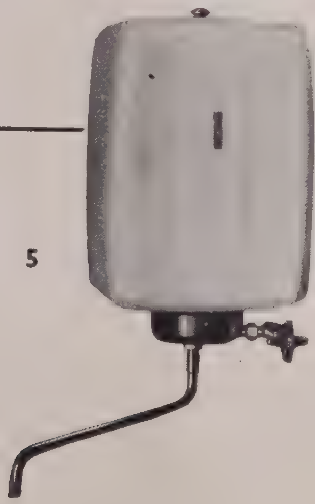

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Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
HEATRAE, LTD., Heatrae Works, Norwich.	"Lido"	Non-pressure	1·5 gal (a) 2·2 gal (b) 3 gal (c)	1 kW (a) 1 kW (b) 2 kW (c)	White or cream	£10 12 6 (a) £11 0 0 (b) £11 19 6 (c)	£2 1 5 (a) £2 2 11 (b) £2 6 9 (c)
	"Lido Big Two"	Non-pressure	2·2 gal	1 kW	White or cream	£10 12 6	£2 1 5
	"Lido Express" (a) and "Lido Express Spray" (b)	Non-pressure	9 gal/hr	3 kW	White or cream	£10 12 6 (a) £11 0 0 (b)	£2 1 5 (a) £2 2 11 (b)
	"Lidomat"	Non-pressure	9 gal/hr	3 kW	White or cream	£10 12 6	£2 1 5
	R.T.A.	Non-pressure	5 gal (a) 12 gal (b) 15 gal (c) 20 gal (d)	3 kW 3 kW 3 kW 3 kW	White	£20 17 6 (a) £28 13 0 (b) £32 3 6 (c) £42 4 0 (d)	£4 1 5 (a) £5 11 9 (b) £6 5 6 (c) £8 4 7 (d)
	R.T.	Pressure	5 gal (a) 12 gal (b) 15 gal (c) 20 gal (d)	1 kW 1·5 kW 1·5 kW 2 kW	White	£19 3 0 (a) £26 18 0 (b) £30 8 0 (c) £40 9 0 (d)	£3 14 9 (a) £5 4 11 (b) £5 18 7 (c) £7 17 9 (d)
	Table pattern	Pressure	30 gal (a) 40 gal (b)	2 kW (a) 6 kW (b)	White	£96 8 6 (a) £106 0 0 (b)	£18 16 1 (a) £20 13 5 (b)

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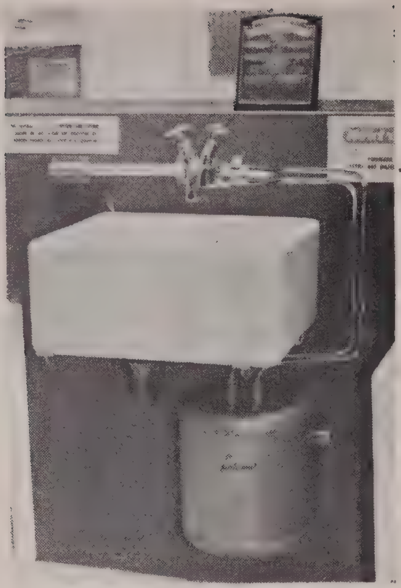

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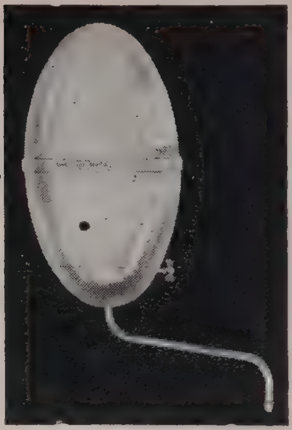

7. *Heatrae "Lidomat" under-sink heater shown in situ*
8. *Main model 25B 2½ gal water heater*
9. *Modern Equipment Co.'s "Sincomatic" 2 gal water heater*

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
HEATRAE, LTD. **Heatrae Works,** **Norwich.** *(continued)*	"One Twenty"	Pressure	20 gal	3 kW	White	£30 1 0	£5 17 2
	"One Thirty"	Pressure	30 gal	3 kW	White	£38 17 6	£7 11 8
	"One Forty"	Pressure	40 gal	3 kW	White	£47 15 6	£9 6 4
	MAX	Pressure	15 gal	2·25 kW	White	£37 0 0	£7 4 4
	G.C.F.	Cistern	30 gal (*a*) 40 gal (*b*)	3 kW (*a*) 6 kW (*b*)	White	£110 5 0 (*a*) £121 16 0 (*b*)	£21 10 0 (*a*) £23 15 1 (*b*)
	R.T.F.	Pressure	30 gal (*a*) 40 gal (*b*)	4·5 kW (*a*) 6 kW (*b*)	White	£84 0 0 (*a*) £95 0 0 (*b*)	£16 7 8 (*a*) £18 10 3 (*b*)
	F.B.	Cistern, rectangular	5 gal (*a*) 12 gal (*b*) 15 gal (*c*) 20 gal (*d*) 30 gal (*e*) 30 gal (*f*)	3 kW (*a*) 3 kW (*b*) 3 kW (*c*) 3 kW (*d*) 3 kW (*e*) 4, 5 or 6 kW (*f*)	White	£29 10 0 (*a*) £36 7 6 (*b*) £40 11 6 (*c*) £47 12 6 (*d*) £60 10 0 (*e*) £67 15 0 (*f*)	£5 15 1 (*a*) £7 1 11 (*b*) £7 18 3 (*c*) £9 5 9 (*d*) £11 16 0 (*e*) £13 4 3 (*f*)
R. & A. MAIN, LTD. **(Electrical Division),** **48, Grosvenor Gardens,** **London, S.W.1.**	"Main 25"	Non-pressure	2½ gal	2 kW	White	£12 0 0 (25A with water tap) £11 3 0 (25B without water tap)	£2 3 11 (25A) £2 0 9 (25B)
MODERN EQUIPMENT CO., LTD., **Court Ash,** **Yeovil,** **Somerset.**	"Sincomatic"	Non-pressure	2 gal	2 or 3 kW	Anodised gold, red or blue (*a*) or white or cream (*b*)	£13 13 4 (*a*) £12 13 4 (*b*)	£2 9 4 (*a*) £2 5 9 (*b*)
RADIATION, LTD., **Electrical Division,** **255, North Circular Road,** **London, N.W.10.**	Jackson "Jill" 921	Non-pressure	1½ gal	0·75 or 1 kW	All white or cream or base plate cover in blue or eau-de-nil	£10 5 0	£2 0 0
	Jackson "Jill" 923	Non-pressure	3 gal	1 or 2 kW	All white or cream or base plate cover in blue or eau-de-nil	£11 0 0	£2 2 11
SANTON, LTD., **Somerton Works,** **Newport,** **Mon.**	"Lincoln"	Non-pressure, wall mounting	2·6 gal	2 kW	White or cream	£10 10 0	£2 0 11
	NPT/1½/E		1½ gal	1·2 kW	White	£10 10 0	£2 0 11
	NPT/3/E		3 gal	1·2 kW	White	£11 15 0	£2 5 10
	NPT/5/E		5 gal	1·2 kW	White	£19 5 0	£3 15 1
	NPT/12/E		12 gal	3 kW	White	£26 15 0	£5 4 4
	NPT/15/E		15 gal	3 kW	White	£28 10 0	£5 11 2

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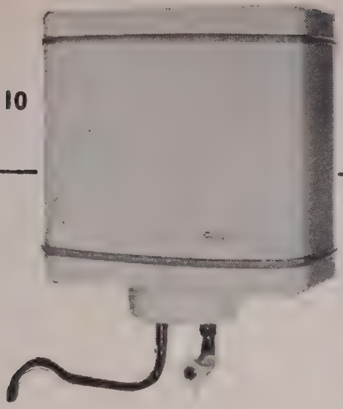

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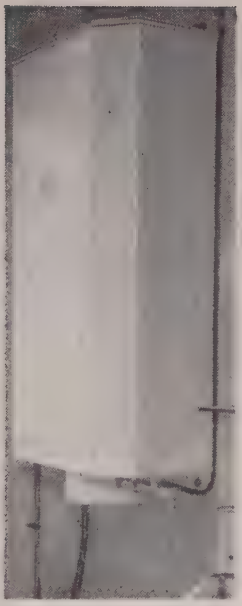

10. *Santon "Lincoln" 2·6 gal water heater*
11. *Jackson "Jill" 3 gal model (Electrical Division of Radiation)*
12. *W. H. Smith "Eziot" type BWT cistern model*

Manufacturer	Name or Model	Type	Capacity	Loading	Finish	Price (excl. tax)	Purchase Tax
SANTON, LTD., Somerton Works, Newport, Mon. *continued)*	NPT/20/E	Non-pressure, wall mounting	20 gal	3 kW	White	£31 10 0	£6 2 10
	PT/5/E	Pressure, wall mounting	5 gal	1·2 kW	White	£17 17 0	£3 9 7
	PT/12/E		12 gal	3 kW	White	£23 5 0	£4 10 8
	PT/15/E		15 gal	3 kW	White	£25 10 0	£4 19 5
	PT/20/E		20 gal	3 kW	White	£28 0 0	£5 9 2
	PT/2½/FM "Conway"	Pressure, floor mounting	2½ gal	1·2 kW	White	£13 0 0	£2 10 9
	PT/20/EFM		20 gal	2 kW	White	£39 0 0	£7 12 1
	PT/30/EFM		30 gal	3 kW	White	£47 10 0	£9 5 3
	DF/5/E	Cistern, wall mounting, cylindrical	5 gal	1·2 kW	White	£24 0 0	£4 13 7
	DF/12/E		12 gal	2 kW	White	£30 0 0	£5 17 0
	FD/15/E		15 gal	2 kW	White	£33 0 0	£6 8 8
	DF/20/E		20 gal	2 kW	White	£34 10 0	£6 14 7
	DF/5/ER	Cistern, wall mounting, rectangular	5 gal	1·2 kW	White with black top and base	£26 0 0	£5 1 5
	DF/7½/ER		7½ gal	1·2 kW		£29 0 0	£5 13 1
	DF/12/ER		12 gal	2 kW		£33 0 0	£6 8 8
	DF/15/ER		15 gal	2 kW		£39 0 0	£7 12 1
	DF/20/ER		20 gal	2 kW		£41 0 0	£7 19 11
	DF/20/EFM	Cistern, floor mounting	20 gal	2 kW	White	£52 0 0	£10 2 10
	DF/30/EFM		30 gal	3 kW	White	£60 0 0	£11 14 0
	"Monmouth"	Automatic dual, floor mounting	12 gal (*a*) and 20 gal (*b*)	3 kW	White	£33 0 0 (*a*) £35 10 0 (*b*)	£6 8 8 (*a*) £6 18 5 (*b*)
W. H. SMITH (EZIOT), LTD., 32, Mansfield Street, Church Gate, Leicester.	"Eziot" "Dee"	Non-pressure	1½ to 3 gal	1 and 2 kW	Cream or white	£10 12 6 to £11 19 6	£2 1 5 to £2 6 9
	"Eziot" WT	Non-pressure	5 to 12 gal	2 kW	Cream or white	£19 0 0 to £27 0 0	£3 14 1 to £5 5 4
	"Eziot" PWT	Pressure	5 to 12 gal	2 kW	Cream or white	£17 15 0 to £26 0 0	£3 9 3 to £5 1 6
	"Eziot" BWT	Built-in cistern	3 to 20 gal	2 to 3 kW	Cream or white	£24 0 0 to £41 15 0	£4 13 7 to £8 2 10
	"Eziot" UWT	Under-basin	1½, 3 and 5 gal	1 to 2 kW	Cream or white	£12 10 0 to £19 15 0	£2 8 9 to £3 17 0
	"Eziot" "Dulec"	Under-draining board	20 gal	3 kW	White	£31 0 0	£6 1 0

RECENT C.E.G.B. CONTRACTS

The Central Electricity Generating Board has placed contracts during the past two months for power stations, transmission lines and transforming stations amounting in the aggregate to approximately £7,127,000. They include the following:—

Blyth "B" power station: Superstructures for main and ancillary buildings and turbo-alternator blocks.—Mitchell Construction Co. C.w. pumps and pumphouse equipment.—Gwynnes Pumps. C.w. civil works and other external work.—Sir Robert McAlpine & Sons (North Eastern).

Thorpe Marsh: Three 4,800,000 gal/hr natural draught cooling towers.—Film Cooling Towers (1925). Booster pumps, and starting and standby boiler feed pumps.—G. & J. Weir. 275 kV switchgear and ancillary apparatus. — Associated Electrical Industries. 11 kV switchgear and accessories.—A. Reyrolle & Co.

Skelton Grange "B": Canal-borne coal wharf and coaling plant foundations.—Mitchell Construction Co.

Padiham "B": Main auxiliary control and instrument cables.—London Electricity Board.

Drakelow "C": Booster pumps, and starting and standby boiler feed pumps for Nos. 9 and 10 (350 MW) sets.—Harland Engineering Co. Preliminary site works.—M. J. Gleeson (Contractors).

Aberthaw: C.w. pumps and equipment.—Gwynnes Pumps.

Rugeley: 3·3 kV air-break switchgear.—Associated Electrical Industries.

West Thurrock: Boiler make-up water treatment plant.—John Thompson Kennicott.

Wolverhampton: 33 kV switchgear.—South Wales Switchgear.

Sundon substation: Three 180 MVA, 275/132 kV auto-transformers. — Crompton Parkinson.

Bootle substation: Two 60 MVA, 132/33 kV transformers.—English Electric Co.

Kirkby substation: Two 60 MVA, 132/33 kV transformers.—Yorkshire Electric Transformer Co.

Salisbury substation: Two 60 MVA, 132/33 kV transformers.—Yorkshire Electric Transformer Co.

Peterborough substation: Two 60 MVA, 132/33 kV transformers.—C. A. Parsons & Co.

Christchurch substation: One 45 MVA, 132/33 kV transformer.—Fuller Electric.

Blyth substation: 275 kV switchgear. A. Reyrolle & Co.

Connah's Quay substation: 132 kV switchgear. — Associated Electrical Industries.

Drakelow substation: 275 kV overhead line diversion.—Watshams.

Taunton-Exeter: 275 kV double-circuit overhead line.—British Insulated Callender's Cables.

Keadby-Wold Newton: 132 kV double-circuit overhead line.—British Insulated Callender's Cables.

Richborough-Thanet and Canterbury: 132 kV double-circuit overhead lines.—Riley & Neate.

Stalybridge substation: 132 kV cables.—Pirelli-General Cable Works.

Battery Research Laboratories

Mr. A. W. Browne, chairman of the Chloride Electrical Storage Co., Ltd., recently officially opened the new central research and development laboratories of the group at Clifton, Swinton, Manchester. The laboratories are laid out in two units, having a total floor area of over 41,500 sq ft. A two-storey building with a floor area of 13,300 sq ft houses the administration section, the library and conference room and the chemical, electro-chemical and metallurgical laboratories. A lofty single-storey building behind, covering 23,000 sq ft, houses the development departments and workshops. These include departments concerned with lead-acid batteries, alkaline batteries, and the development and testing of special manufacturing plant of all types.

Research is being pursued, not only on the development of improved lead-acid batteries, which are the most widely used, but also on other electrical storage systems, particularly those using nickel-cadmium electrodes in an alkaline electrolyte and those employing silver oxide and zinc electrodes with caustic potash electrolyte. Work is also in progress on the development of batteries of unconventional design that will fit into small or odd-shaped spaces and stand up to exacting conditions of temperature and stress, such as are required for guided missiles, or water-activated batteries for air-sea rescue applications and meteorological balloons. A section of the laboratories is studying some of the many problems involved in the development of a practical fuel cell.

The new central research and development laboratories of the Chloride Electrical Storage Co., Ltd.

Anglo-Soviet Trade Agreement

The Board of Trade announces that a delegation from the Soviet Union will be arriving in this country on 6th June to begin discussions with the Board of Trade on the following day about the operation of the Anglo-Soviet Five Year Trade Agreement of May, 1959. The Agreement provides that representatives of the two Governments would meet at least once a year, alternately in London and Moscow, to examine the carrying out of the provisions of the Agreement and, if necessary, to prepare recommendations to one or both Governments for the further improvement of trade relations between the two countries. The Soviet delegation will be led by Mr. P. N. Kumykin, a Deputy Minister of Foreign Trade in the Soviet Union. The United Kingdom delegation will be led by Mr. F. J. Erroll, M.P., Minister of State in the Board of Trade.

Cubicle Switchboards

by **VARILECTRIC**

UNIT CONSTRUCTION

embodying Combination Fused Switches from our ASTA Type Tested 30 MVA range. 60 amperes to 750 amperes. Standardised dimensions permit ease of assembly. Great flexibility of layout and facilities for extensions.

Our other products include:—

- RISING MAIN SYSTEMS
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VARILECTRIC LIMITED

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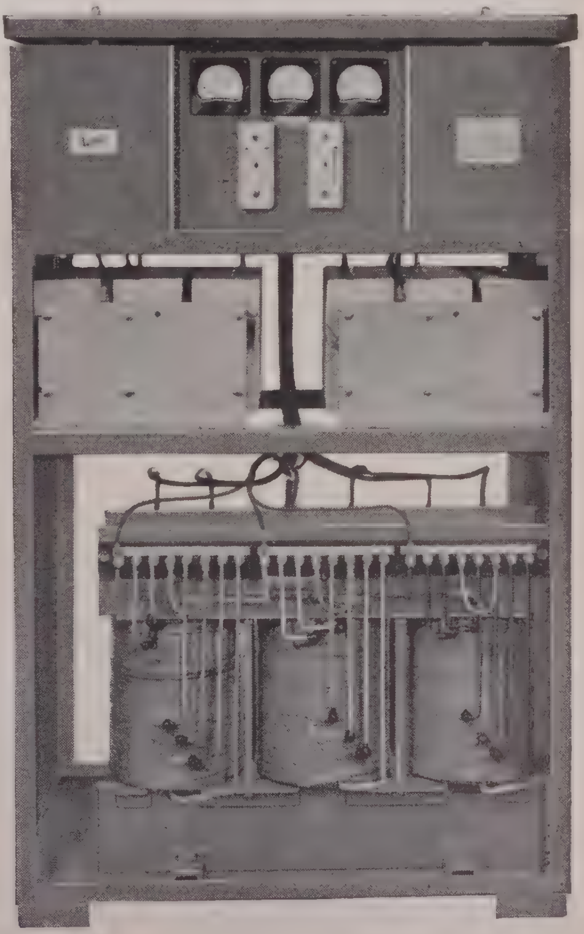
Legg

Rectifying Equipment

for all purposes where a D.C. supply is required from an A.C. source.

Illustrated is a Legg 3-phase Germanium Rectifier. Output 440 volts D.C., 80 amps.

Rectifiers of Germanium, Selenium and Silicon types are available to suit various loadings.



Legg (Industries) also design and manufacture Battery Charging Equipment for all types of battery operated trucks and vehicles. Our technical staff will be pleased to advise you on your own particular problem.

Legg Legg Legg

Legg (Industries) Ltd., Williamson Street, Wolverhampton.
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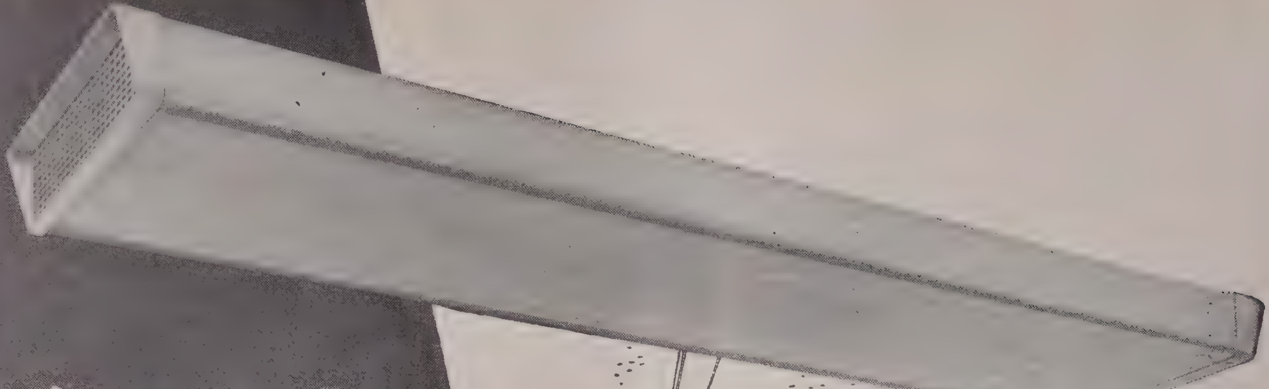

Dynamic

NEW lighting...

As the basis for new and ever more ingenious lighting arrangements, 'Flo-line' fittings open up for the lighting specialist tremendous opportunities for developing new business.

BENJAMIN REGD. **FLO-LINE**

for those who design with light

'Flo-line' combines the outstanding efficiency of Benjamin fluorescent lighting with exciting and original design of an outward simplicity, making for easy harmony with decorative schemes.

The minicell louvre is combined in one unit with translucent side panels to make an all plastic diffuser of entirely new characteristics.

Comfortable yet cheerful seeing conditions are ensured, with high illumination values.

Controllable upward light. Ceiling or pendant mounting. Access to lamps and control equipment is quick and easy. Side panels are double walled for strength.

Apparent depth of fitting only $3\frac{1}{2}$ in. Total depth $4\frac{3}{8}$ in. Half inch cube spaces in louvre give 45° cut-off.

Installation accessories include couplers for continuous line arrangements and channel junction boxes for geometrical layouts.

Uses 2 x 5 ft. 80-Watt lamps. Quick or switch start control gear.

The entire louvre swings down for cleaning and maintenance.

better lighting by BENJAMIN REGD.

BRITISH LIGHTING COUNCIL BLC MEMBER

THE BENJAMIN ELECTRIC LIMITED · TOTTENHAM · LONDON N.17
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Smee's B158

NEW ELECTRICAL EQUIPMENT

Portable Welding Generator

An addition to the range of engine-driven welding generator units available from the Lincoln Electric Co., Ltd., is the type SA 200 driven by a Ruston & Hornsby two-cylinder air-cooled diesel engine developing 21 b.h.p. at 2,000 r.p.m. The unit incorporates a generator unit providing 30-275 A hand welding current or 200 A continuously, and is suitable for metallic arc welding with bare or heavily coated electrodes, also for carbon arc welding. The open circuit voltage can be adjusted in a continuous sequence by a shunt field rheostat whilst welding current is controlled by adjustment of both the series and shunt fields.

Lincoln Electric portable welding generator

The generator field rheostat and current regulating switch are mounted on a vertical steel control panel, and terminals with wing nuts are provided on this panel to facilitate changing the polarity of the welding current. The generator is mounted directly on to the engine bell housing and is driven by a coupling which connects to the flywheel by flexible bushes. Further details of this unit are available from the sales department of the company at Black Fan Road, Welwyn Garden City, Herts.

Heating Electrode

An electrode for applying a rapid and concentrated heat to metal before welding, bending or straightening has been developed and is being marketed by the Welding Electrode Division of the English Electric Co., Ltd., Accrington. The "Thermees" electrode may be used on any standard metal and in any position. Heat can thus be applied in an exact spot and in normally inaccessible places without any special flame or induction heating equipment. Handled like a normal electrode, it requires no special equipment or technique. It can be used on a.c. or d.c. welding plant. For best results the a.c. supply should have an open circuit voltage of 80 to 85 V. The temperature rise of the metal is regulated by the rate of travel and number of passes of the electrode. Any residual scale or oxide can easily be brushed off to leave the surface clean.

Level Indicator

The level indicator Type T.R.56L developed by Panax Equipment, Ltd., Holmethorpe Industrial Estate, Redhill, Surrey, is designed for the determination of levels in closed cylinders or pipes using a radioactive source and a Geiger counter probe.

The apparatus can be used on cylinders with diameters of up to 7¼in with the standard probe. Levels can be determined with an accuracy of better than ¼in. A backed off meter is used to give an open scale over the operating range and a wide range sensitive control enables the instrument to be used with a variety of containers. Transistors are used exclusively in this instrument both to develop the fully stabilised voltage required by the Geiger counter and to amplify and meter the counter output.

Power is derived from two 1·5 V cells in series, housed in a self-contained waterproof compartment. Battery life under normal operating conditions is approximately 400 hours. The instrument is supplied complete with canvas case, probe, a radioactive source and detector and operator's handbook.

Fluorescent Lighting Fittings

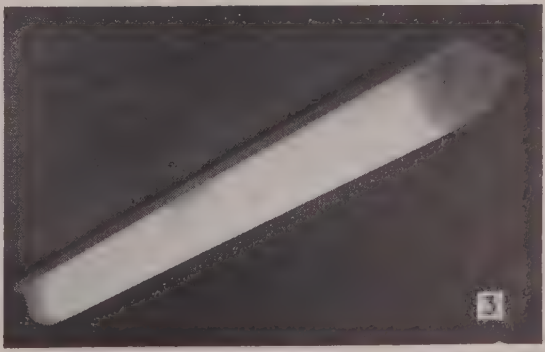
The new "Vistalite" range of fluorescent fittings, manufactured by Courtney, Pope (Electrical), Ltd., Amhurst Park Works, Tottenham, N.15, can be ceiling or wall mounted or supplied as free-standing units. The basic fitting consists of metal end caps housing the control gear, which can be supplied in a range of colours with a plain plastic diffuser. The fitting can be supplied with a formed plastic diffuser or a pierced metal surround. The units are 4ft 40 W fittings and there is also a 2ft 20 W vertical mounted unit included in the range.

A simple clip-on diffuser that transforms a bare 5ft fluorescent fitting into an attractive lighting fitting is being manufactured by the Siemens Ediswan Lamps and Lighting Department, A.E.I. Radio and Electronic Components Division, 38-39, Upper Thames Street, London, E.C.4. The unit (Catalogue No. 18/8) is made of reeded "Diakon" and is fitted with two spring clips, designed to push on to and grip a 1½in diameter fluorescent

1 *Courtney, Pope "Vistalite" 4ft 40 W fluorescent fitting*

2 *Siemens Ediswan clip-on diffuser for fluorescent fittings*

3 *Troughton & Young type T.535 "Tubalux" fluorescent fitting*



lamp. The price is £2 13s plus 9s 9d purchase tax.

Two new surface models have been added to the range of "Tubalux" fluorescent fittings manufactured by Troughton & Young (Lighting), Ltd., 143, Knightsbridge, London, S.W.1. Model T.435 is designed for a single 4ft 40 W tube and Model T.535 for a single 5ft 80 W tube. Both have white stove enamelled metalwork and the moulded opal "Perspex" diffuser lifts out for access.

"Hoovermatic" Table Top Lid

It is announced by Hoover, Ltd., Perivale, Greenford, Middlesex, that all future "Hoovermatic" washing machine/spin dryers will be fitted with a new lid at no extra charge. The lid has a working surface of a hard plastic material with grey and white mottled pattern and the sides are of highly polished aluminium alloy. Unobtrusive handles are fitted at each end. Lids for existing "Hoovermatics" are available at £3 17s 6d each.

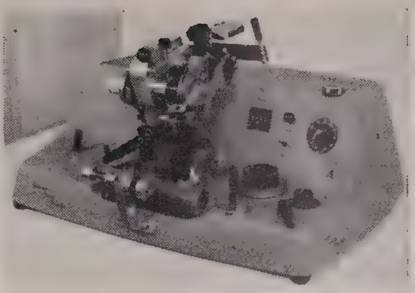
All-Weather Clock

To meet a demand for a comparatively small exterior clock, English Clock Systems, a branch of Smiths Clock & Watch Division, 179-185, Great Portland Street, London, W.1, have produced a model with an all-copper case, finished bronze. This new model, named "Monsoon," is completely sealed against adverse weather conditions and is equally suitable for installing in damp industrial atmospheres. The 12in metal dial with black hands and numerals is protected by a clear glass cover sealed with a waterproof compound. A synchronous movement is fitted for connection direct to an a.c. supply. The price is £16 plus £3 purchase tax.

Smiths "Monsoon" all-weather clock

Toroid Winding Machine

The "Gorman" model 600 high speed toroid winding machine introduced into the U.K. by Aveley Electric, Ltd., Ayron Road, Aveley Industrial Estate, South Ockendon, Essex, incorporates features which allow for rapid core insertion and removal. Cores may be rotated as desired, either through 360°, or segmentally over any angle up to 360°, or may be adjusted for a fixed increment of progression on a constant angle of rotation. For bank winding, the machine can be set for any sector and rate of progression. A transistorised electronic counter and Sodeco register is fitted to ensure accurate counting of turns.



Aveley Electric "Gorman" toroid winding machine

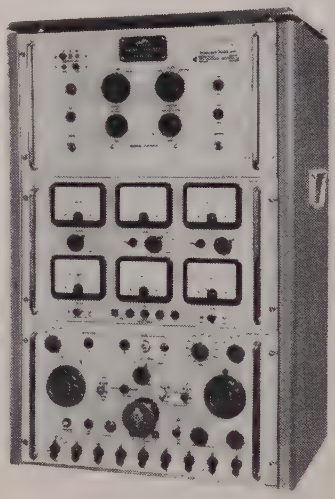
To maintain a constant drive, the core is rotated by three co-ordinated driving rollers which can be continually centred by a single lever. The speed of rotation is controlled by adjusting a vernier dial. The machine is provided with overriding hand or foot, or automatic control and, to ensure stopping at high speeds without wire breakage, a dynamic braking system is employed. Provision is also made for the connection of a predetermined counter, which will stop the machine automatically after the required number of turns have been made. The machine has a variable winding speed between 0 and 1,200 turns per minute and can handle wire between 27 and 48 s.w.g. The core size range allows for a minimum finished i.d. of 0·055in and a maximum o.d. of 2in with a maximum height of 1in. Eleven shuttles ranging from 0·055in to 0·375in are available. The weight of the machine is 55 lb.

Drying Cabinet

A new model of the "Babylux" electrically heated drying cabinet, manufactured by Aerialite, Ltd., Castle Works, Stalybridge, Ches., has been announced. It is now fitted with hand grips on the top of the lid to serve the double purpose of ease in lifting and replacing the lid, and also for hanging the lid on the side of the appliance when in use. An airing rack has also been fitted as standard equipment. The price of the dryer remains the same.

Universal Valve Test Set

A general purpose test set for valves to British and American specifications has been developed by APT Electronic Industries, Ltd., Byfleet, Surrey. In addition to the stabilised power supplies and meters required for measurements of static characteristics, the tester incorporates an a.c. bridge which enables direct readings of mutual conductance to be made. The power supplies comprise a 0-300 V anode supply, rated for 250 mA maximum continuous output current, screen supply of 0-300 V with a maximum current of 50 mA, control grid supplies of 0-25 V positive and 0-100 V negative, and a heater/filament supply of 0-55 V (a.c.) with a maximum power of 25 W. All supplies are fully variable, and the d.c. supplies are stabilised to 0·1 per cent over the full load range and for variations in input of ±10 per cent of the nominal. Six laboratory-grade meters are used in conjunction with selector switches to measure anode, screen, grid and heater voltages and currents. A switch by which various resistors, internal and external, may be selected for cathode biasing is provided. The complete equipment comprises three units, each designed for mounting on a 19in rack, and the overall size is approximately 33 by 22 by 18in and the weight is 180 lb with case. Power requirements are 300 VA from single-phase a.c. mains of 200-250 V, 45-65 c/s. The tester, with case, costs £450 ex works.

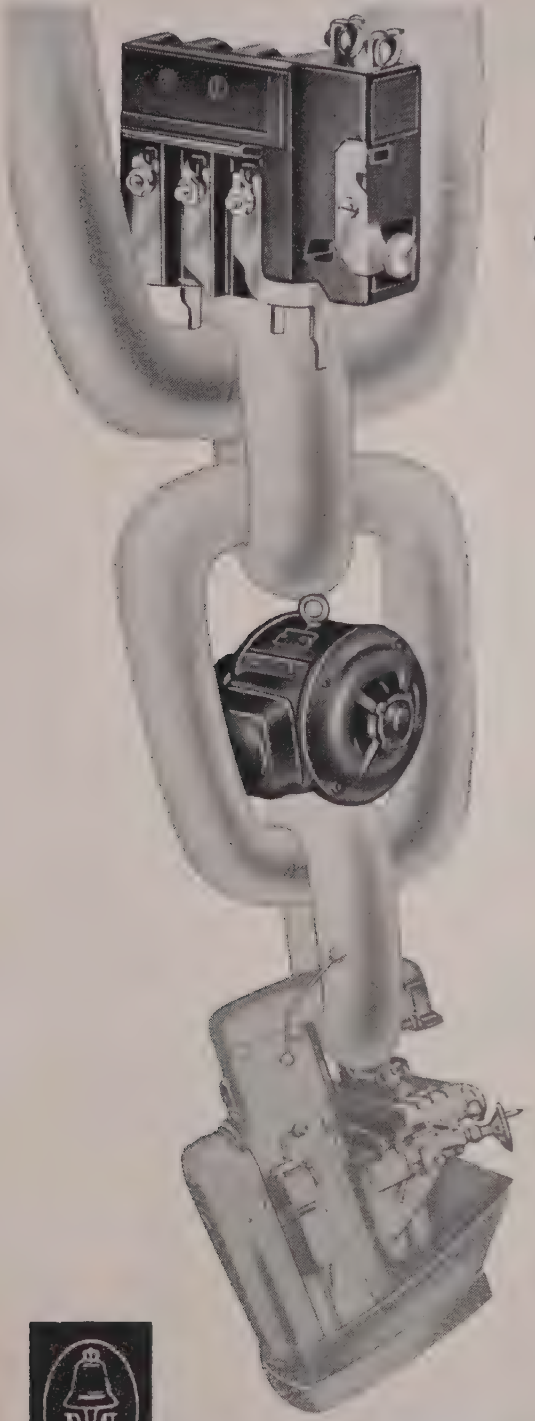


APT Electronic Industries valve test set

Quick-fix Terminals

A range of terminals manufactured by D.J. Equipment (Hersham), Ltd., 43, Queens Road, Hersham, Walton-on-Thames, Surrey, and designed to clip into a mounting rail, is described in a leaflet which gives types, sizes, current carrying capacities and prices. The terminals have a spring loaded attachment which securely fixes them to the mounting rail. A feature is the small space required for multi-way connections.

A New Philosophy in Motor Controls



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Thermal overload relay

MOTOR
MACHINE

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3-Phase Protecting unit gives positive motor protection under all faulty conditions, even on small ground failure in one phase when current is too low for quick interruption by the next fuse.

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Field Adjustment for all three phases need be set only on one dial, at exact motor current. Full use of highest motor output is always possible, by continuous range of adjustment.

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Bridges

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It is tailor-made for time-saving, and includes the BRIDGES $\frac{3}{8}$″ 'MORE POWER' Drill — with a choice of Side Handle, Saw Grip or Pistol Grip Models. Complete with full range of accessories.

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Hole-cutting — in Tanks and Cylinders.

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1	,,	1″ Carbon Steel Holsaw
1	,,	$1\frac{1}{2}$″ Carbon Steel Holsaw
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3	,,	1″ Carbon Steel Holsaw Blades
3	,,	$1\frac{1}{2}$″ Carbon Steel Holsaw Blades
2	,,	$\frac{1}{4}$″ Pilot Drills
1	,,	CT8 Carbide Drill
1	,,	CT10 ,, ,,
1	,,	CT12 ,, ,,
1	,,	CT14 ,, ,,
1	,,	A14 $\frac{1}{4}$″ Wood Auger
1	,,	A38 $\frac{3}{8}$″ Wood Auger
1	,,	A12 $\frac{1}{2}$″ Wood Auger
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1	,,	Set of 4 High Speed Twist Drills ($\frac{1}{16}$″, $\frac{1}{8}$″, $\frac{3}{16}$″, $\frac{1}{4}$″)
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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1955

1437. Eisler, P.—Production of electrical components from metal foils. 21st March, 1956. (835214.)

5241. Elemelt, Ltd.—Methods of and furnaces for melting and refining glass electrically. 12th April, 1956. (835202.)

8318. Communications Patents, Ltd.—Navigational and radar training apparatus. 15th March, 1956. (835218.)

14706. Electric & Musical Industries, Ltd.—Mounting of members in electron discharge devices. 22nd May, 1956. (835220.)

16010. Siemens-Schuckert (Great Britain), Ltd., Morton, J. D., and Dixon, B. J.—Electrical protective systems. 4th June, 1956. (835223.)

16232. British Telecommunications Research, Ltd.—Waveguide attenuators. 6th September, 1956. (835224.)

16726. Lacy, R. D.—Two-phase electric motors. 8th June, 1956. (835403.)

17550. English Electric Co., Ltd.—Non-linear electric circuit arrangements. 15th June, 1956. (835404.)

18723. British Insulated Callender's Cables, Ltd.—Overhead electric traction systems. 27th June, 1956. (Cognate application 2539, 25th January, 1956.) (835227.)

19273. Permutit Co., Ltd.—Ion-exchange processes. 21st June, 1956. (Addition to 714642.) (835206.)

19556. Metropolitan-Vickers Electrical Co., Ltd.—High voltage electrical apparatus. 6th July, 1956. (835405.)

20335. Metropolitan-Vickers Electrical Co., Ltd.—Bushings for high voltage electrical apparatus. 13th July, 1956. (835406.)

20921. Lister & Co., Ltd., R. A.—A.c. generating plant. 19th July, 1956. (835228.)

24101. English Electric Co., Ltd.—Panel mounting lampholders. 17th August, 1956. (835230.)

25605. Babcock & Wilcox, Ltd.—Tubulous vapour generating and vapour heating units and a method of operating such units. 4th September, 1956. (835232.)

26746. British Thomson-Houston Co., Ltd.—Over-voltage protection for d.c. generators. 18th September, 1956. (835006.)

26747. British Thomson-Houston Co., Ltd.—Over-speed protection for electric motors. 18th September, 1956. (835007.)

37345. English Electric Co., Ltd.—Electrical measuring means for nuclear reactors. 7th December, 1956. (835410.)

1956

5666. Permutit Co., Ltd.—Ion-exchange processes. 21st June, 1956. (Divided out of 835206.) (Addition to 714642.) (835207.)

16283. United States Atomic Energy Commission.—Remote control manipulator. 25th May, 1956. (834663.)

16571. Eitel-McCullough, Inc.—Electron tubes. 29th May, 1956. (834664.)

17439. Raimbault, P.—Electronic systems for controlling the speed of d.c. motors. 6th June, 1956. (834569.)

17505. Patent-Treuhand-Gesellschaft für Elektrische Gluhlampen.—Method of manufacturing electric lamps. 6th June, 1956. (834424.)

20061. General Electric Co.—Electric timers. 28th June, 1956. (834427.)

20225. Sperry Rand Corporation.—Transistor control circuits. 29th June, 1956. (834428.)

20347. Telefunken G.m.b.H.—Electromechanical transducers for use in sound recording or reproducing apparatus. 2nd July, 1956. (834572.)

23392. British United Shoe Machinery Co., Ltd.—Machines adapted for use in assembling electrical components upon workpieces. 30th July, 1956. (Addition to 802658.) (834431.)

25946. Telephone Manufacturing Co., Ltd.—Switch means for sequentially selecting electrical contacts. 2nd August, 1957. (834825.)

26134. General Electric Co.—Single-phase induction motors of the shaded-pole type. 27th August, 1956. (834896.)

27281. Belling & Lee, Ltd.—Manufacture of electrical components. 30th August, 1957. (834898.)

27282. Belling & Lee, Ltd.—Electrical contact elements. 6th September, 1957. (834899.)

28346. Rank Cintel, Ltd.—Cathode-ray tube flying spot scanners. 17th September, 1957. (834669.)

28780. Electrolux, Ltd.—Absorption refrigerating apparatus. 20th September, 1956. (834901.)

28942. General Electric Co.—Electric contact brush assembly. 21st September, 1956. (834902.)

30441. General Electric Co.—Positional control systems. 5th October, 1956. (834439.)

32073. National Research Development Corporation.—Waveguide components. 30th December, 1957. (834441.)

32083. Zenith Radio Corporation.—Subscription television computer. 22nd October, 1956. (834442.)

32729. British Thomson-Houston Co., Ltd.—Protective equipment for nuclear reactors. 8th October, 1957. (834908.)

34367. Smith & Sons (England), Ltd., S.—Devices for anchoring wires or cables. 4th July, 1957. (834446.)

1957

12928. Philips Electrical Industries, Ltd.—Devices for determining very low gas pressures. 23rd April, 1957. (834470.)

16251. Calor Gas (Distributing) Co., Ltd.—Electromagnetic flame failure gas valves. 26th February, 1958. (834837.)

16350. Electronics (Bradford), Ltd.—Electric stop motions for textile machines. 25th April, 1958. (834475.)

17071. Associated Television, Ltd.—Lighting arrangements. 28th May, 1958. (834840.)

24688. Fischer, K.—Electric cooking appliance. 6th August, 1957. (834488.)

26234. United States Atomic Energy Commission.—Method of operating nuclear reactors. 20th August, 1957. (834701.)

27761. Marconi's Wireless Telegraph Co., Ltd.—Doppler radar systems. 25th June, 1958. (834493.)

28369. Marconi's Wireless Telegraph Co., Ltd.—Frequency measuring and responsive circuit arrangements. 1st July, 1958. (834494.)

29236. Fernseh G.m.b.H.—Television apparatus. 17th September, 1957. (834606.)

33717. Gardner, L. F. (Unterreiner, J., Honauer, E., and Baer, E. (trading as Unterreiner & Co., J.)).—A.c. generators for medium frequencies. 29th October, 1957. (834952.)

34330. Fernseh G.m.b.H.—Television camera apparatus. 4th November, 1957. (834497.)

35123. Siemens & Halske A.G.—Circuit arrangements for signalling between a movable object and a fixed position by means of a controlling magnetic field. 11th November, 1957. (834498.)

36407. Standard Telephones & Cables, Ltd.—Electric attenuators. 22nd November, 1957. (834619.)

36442. General Electric Co.—Magnetic tape writing system. 22nd November, 1957. (834722.)

38339. Westinghouse Electric Corporation.—Transistors. 10th December, 1957. (834501.)

1958

2460. Standard Telephones & Cables, Ltd.—Electrodes for electric discharge devices. 24th January, 1958. (834861.)

4387. Standard Telephones & Cables, Ltd.—Electric attenuators. 11th February, 1958. (834618.)

5054. Marconi's Wireless Telegraph Co., Ltd.—Radio beacons. 6th October, 1958. (834507.)

7556. Gilbert & Barker Manufacturing Co.—Snap action electric switch actuating mechanism. 10th March, 1958. (834955.)

7910. National Cash Register Co.—Electrical sequencing control switch unit. 12th March, 1958. (834957.)

7938. English Electric Valve Co., Ltd.—Magnetic focusing systems for travelling wave tubes. 11th December, 1958. (834958.)

9812. Standard Telephones & Cables, Ltd.—Code converting arrangements for pulse code modulation systems. 27th March, 1958. (Addition to 806397.) (834624.)

10302. English Electric Valve Co., Ltd.—Magnetrons. 30th April, 1958. (834628.)

11111. Kanthal A.B.—Manufacture of electric resistance elements. 8th April, 1958. (834739.)

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that dates for their functions do not clash with others already arranged

TUESDAY, 7th JUNE

Hammersmith.—Windsor Castle Hotel, 134, King Street, 7 p.m. A.S.E.E. West London Branch. Annual general meeting.

Portsmouth.—At the Ministry of Labour and National Service, Lake Road, 7.30 p.m. A.S.E.E. Portsmouth and District Branch. Annual general meeting.

Reading.—Southern Electricity Board, Vastern Road, 7.30 p.m. A.S.E.E. Reading and Districts Branch. Annual general meeting.

WEDNESDAY, 8th JUNE

Birmingham. — Engineering Centre, Stephenson Place, 6.30 p.m. A.S.E.E. Birmingham Branch. Annual general meeting.

London.—45, Great Peter Street, Westminster, S.W.1, 7 p.m. Women's Engineering Society, London Branch. Annual general meeting.

THURSDAY, 9th JUNE

Bradford.—Midland Hotel, 7 p.m. A.S.E.E. Bradford and District Branch. Annual general meeting.

London.—Great George Street, Westminster, S.W.1. Institution of Civil Engineers. Annual general meeting.

Wimbledon.—Prince of Wales Hotel, 7.15 p.m. A.S.E.E. South West London Branch. Annual general meeting.

FRIDAY, 10th JUNE

Hanley.—Grand Hotel, 7.30 p.m. A.S.E.E. Stoke and Crewe Branch. Annual general meeting.

Luton.—Luton College of Technology, Park Square, 8.15 p.m. A.S.E.E. Luton Branch. "Diesel-Electric Locomotives."

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Electricity Commission of New South Wales, Sydney. 1st August. Seven 330 kV, 133 MVA auto-transformers. (E.S.B. 13524/60.)*

Fremantle Harbour Trust. 15th July. Diesel electric or diesel hydraulic shunting locomotives. (E.S.B. 14235/60.)*

Postmaster General's Department, Melbourne. 7th July. Electrical resistance wire. (E.S.B. 13985/60.)*

Batley.—Corporation. 20th June. Street lighting equipment. (See this issue.)

Bognor Regis.—U.D.C. 13th June. Electric power-driven paper baling press capable of producing bales weighing approx. 2 cwt. R. W. J. Hill, clerk, Town Hall.

Cambodia.—Cambodian Government. 20th June. Equipment for a television station. (E.S.B. 13987/60/I.C.A.)*

Canada.—Manitoba Hydro-Electric Board. 1st November. Three 150,000 h.p. turbines for the Grand Rapids generating station. (E.S.B. 13924/60.)*

Carrickfergus (Co. Antrim).—County Education Committee. 13th June. Electrical installation in Carrickfergus Grammar School. McAuslan & Abbott & Partners, 16, Bedford Street, Belfast.

Egypt.—Ports and Lighthouses Administration, Alexandria. 18th July. Harbour radar station. (E.S.B. 13249/60.)* 22nd August. Five radio beacon stations. (E.S.B. 13248/60.)*

Cairo Electricity and Gas Administration. 5th July. Switchgear and transformers. (E.S.B. 13792/60.)*

Greece.—State Procurements Service, Athens. 13th June. Electrical testing instruments and electric furnace. (E.S.B. 13800/60.)*

Kettering.—Corporation. 30th June. Street lighting equipment. (See this issue.)

New Zealand.—G.P.O., Wellington. 8th July. Potentiometers and resistors. (E.S.B. 13952/60.)*

Wellington Corporation. 13th July. Two d.c. switchboards for traction use. (E.S.B. 13571/60.)*

Pakistan.—Posts and Telegraphs Department, Karachi. 22nd June. Porcelain insulators. (E.S.B. 13564/60.)* Copper wire and accessories. (E.S.B. 13563/60.)* 27th June. Automatic circuit-breakers. (E.S.B. 13993/60.)* 28th June. Paper core, quad trunk armoured cables. (E.S.B. 13718/60.)*

West Pakistan Water Power Development Authority, Lahore. 13th June. Distribution transformers, ranging from 25 kVA to 200 kVA. (E.S.B. 14214/60/D.L.F.)*

Rhodesia and Nyasaland.—Bulawayo Corporation. 15th June. Insulated wire, armoured cables and conductors. (E.S.B. 14202/60.)*

Rosneath.—Director General, Navy Works, Admiralty. Electrical installation for a P.O.L. storage depot. (See this issue.)

Saddleworth.—U.D.C. Street lighting equipment. (See this issue.)

South Africa.—Union Tender Board, Pretoria. 22nd June. One 500 kVA transformer. (E.S.B. 13946/60.)* 23rd June. Telephone switchboard indicators and key levers. (E.S.B. 13704/60.)*

Thailand. — Metropolitan Electricity Authority, Bangkok. 17th June. Power capacitors. (E.S.B. 13795/60/D.L.F.)* 20th June. Overhead line equipment. (E.S.B. 13796/60.)*

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Amersham.—Redevelopment of St. George's estate, White Lion Road; H. E. Buxton, clerk, Elmodesham House, High Street.

Birkenhead.—Hospital, Arrowe Park; T. N. Mitchell, architect, 55, Castle Street, Liverpool.

Bishopbriggs (Lanark).—Primary school, Balmuildy Road; D. G. Bannerman, county architect, 34, Albert Street, Motherwell.

Bournemouth.—Eighteen-storey hotel, with shops, etc., Exeter Hotel site; Ronald Sims, architect, 2a, Holdenhurst Road.

Cardiff.—Three-storey and single-storey blocks for new sub-divisional police station, Cowbridge Road West, Ely; Architects' Department, 12, Park Place.

Carlisle.—Extensions to Carlisle Grammar School (Stage 3); L. J. A. Stow, city engineer, 18, Fisher Street.

Darlington.—Factory additions, Aycliffe, for Kleemann Plastics, Ltd., and E.N.V. Engineering, Ltd.; Edgar Lawson, Ltd., contractors, Victoria Road, Darlington.

Doncaster.—Three-storey office block (£100,000); British Ropes, Ltd., Carr Hill.

Durham.—Grammar/technical school at Peterlee (£242,000); G. M. Pearson & Son, builders, Front Street, Hetton, Co. Durham.

Exeter.—Nursing home, Lyndhurst Road (£100,000); J. Stanley Beard, Bennett & Wilkins, architects, 101, Baker Street, London, W.1.

Falkirk.—Shopping centre; W. Talbot, quantity surveyor, 175, St. Vincent Street, Glasgow.

Guildford.—Extensions to Municipal Offices; J. Marks & Partners, quantity surveyors, 41, Parliament Street, London, S.W.1.

Hertford.—Houses, flats and maisonnettes (129), Horns Mill estate; town clerk, The Castle.

Hull.—Factory, Hodge Street; Hull Gauge & Tool Co., Ltd., Beverley Road.

Ilford.—Flats (66), Ingleshurst Gardens and Green Lane; borough engineer, Town Hall.

Kirkby.—Works, Horne House Lane; Fisher & Ludlow, Ltd., Albion Works, Kingsbury Road, Birmingham.

Leeds.—Office block, Eastgate, for the National Deposit Friendly Society; Ansell & Bailey, architects for scheme, 12, Gray's Inn Square, London, W.C.1.

London.—Dwellings (98), with laundries, clubroom, etc., Gibbon Road, Camberwell; borough architect.

Offices, shops and showrooms, Newgate Street, E.C.; Trehearne & Norman, Preston & Partners, architects, 83, Kingsway, W.C.2.

Office block, Golden Square, Soho (£222,000); J. Jarvis & Sons, Ltd., 239, Vauxhall Bridge Road, S.W.1.

Additions for Department of African and Oriental Studies, University Precinct, Gower Street, Bloomsbury; Adams, Holden & Pearson, architects, 38, Gordon Square, W.C.1.

Office block, 32/6, Great Portland Street, Marylebone; Fitzroy Robinson & Partners, architects, 3, Gray's Inn Square, W.C.1.

Middlesex.—Grammar school for boys, Hanworth (£252,845) and technical college, Southgate (£414,500); C. G. Stillman, county architect, 1, Queen Anne's Gate Buildings, London, S.W.1.

Morden.—Fourteen-storey office, showroom and super-store block; Bernard Sunley & Sons, Ltd., 25, Berkeley Square, London, W.1.

Morpeth.—Houses (18), Mitford, for R.D.C.; J. R. Miles, surveyor, Dacre Street.

Newburn (Northumberland). — Factory, Stanners estate; Aveling-Barford, Ltd., engineers, Grantham.

Newcastle-on-Tyne.—Flats (147), Newbiggin Hall estate; city architect, 18, Cloth Market, Newcastle.

Five old people's homes (£250,000); city architect.

Newton Aycliffe (Co. Durham).—Houses (222); chief architect, Aycliffe Development Corporation.

Northumberland.—Infants' school, Seaton Sluice; county architect, County Hall, Newcastle-on-Tyne.

Northwood.—Arts block for Merchant Taylors' School; R. E. Enthoven, architect, 4, Raymond Buildings, Gray's Inn, London, W.C.1.

Nuneaton.—Flats (136), Abbey Street; Fredk. Gibberd, architect, 8, Percy Street, London, W.1.

Potters Bar.—Civic centre, to be erected in stages; Clifford Culpin, architect to U.D.C., 39, Doughty Street, London, W.C.1.

Redditch.—Works extensions; Hewell Spring Co., Ltd., High Street, Astwood Bank.

Rothwell.—Houses (32), Styebank Lane estate; R. A. Easdale & Son, architects to U.D.C., County Chambers, Bradley Street, Castleford.

Ruislip.—Extensions to offices, for British European Airways; Covell & Matthews, architects, 34, Sackville Street, London, W.1.

St. Austell.—Civic hall (about £75,000); surveyor, Municipal Offices.

Salisbury.—Nurses' training school, General Infirmary; Harding, McDermott & Partners, mechanical and electrical consultants, 17, Doughty Street, London, W.C.1.

Sandbach.—Three-storey flats (36); H. J. Rees, surveyor, Council Offices, Crewe Road, Sandbach, Cheshire.

Scarborough.—Extensions to Filey Road Training College, and George Pindar Modern School; county school architect, County Hall, Northallerton.

Sheffield.—Church, Blackstock Road, Gleadless Valley; J. Mansell Jenkinson, architect, 53, Wilkinson Street.

Showrooms and offices, High Street and Angel Street; N. Martin, architect, Hudson Road Mills, Leeds, 9.

Skipton.—Extensions to General Hospital (£124,000); F. Shepherd & Son, Ltd., builders, Blue Bridge Lane, York.

Stockton-on-Tees.—Proposed new North Tees-side Hospital for Newcastle Regional Hospital Board (£1,000,000); Alison & Hutchison, architects, 4, Rothesay Terrace, Edinburgh.

Sunderland.—Works for the production of castings for the motor car industry; Hepworth & Grandage, Ltd., Bradford.

Wolverhampton.—Office block, Stafford Road; Goodyear Tyre & Rubber Co. (Great Britain), Ltd., Wolverhampton.

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* This information is extracted from the Board of Trade *Export Service Bulletin.* Inquiries should be addressed to the Board of Trade, Export Services Branch, Lacon House, Theobald's Road, London, W.C.2 (Telephone: Chancery 4411, Ext. 738), quoting the reference given.

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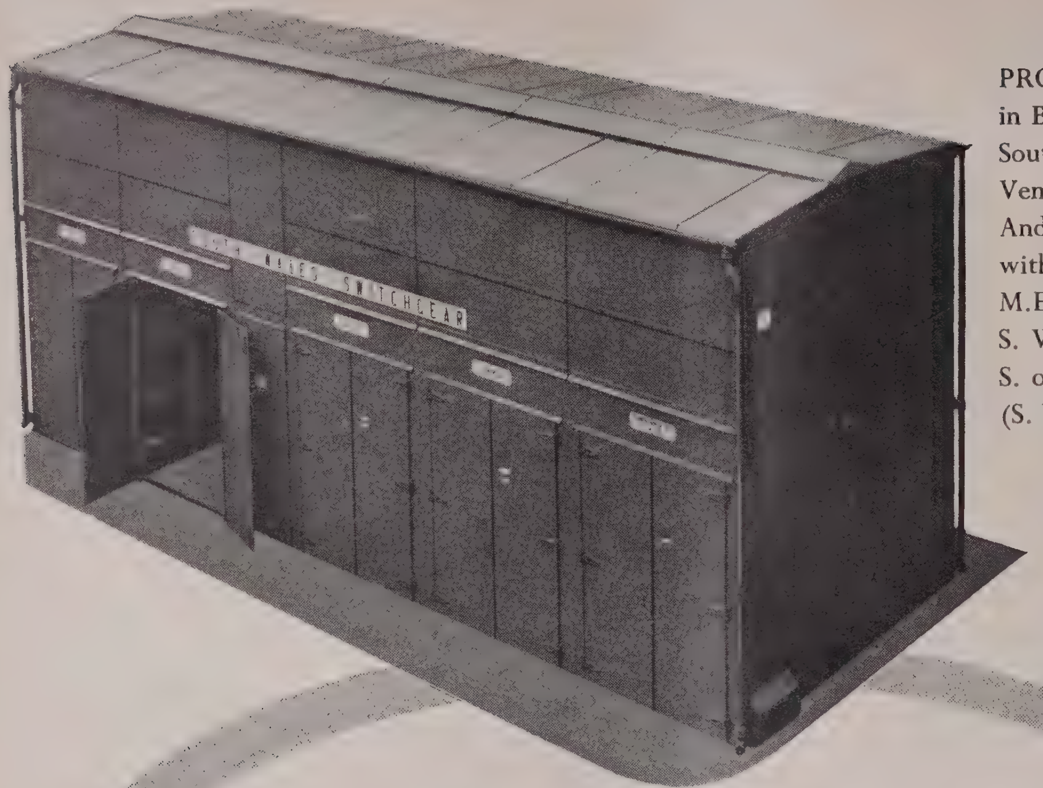

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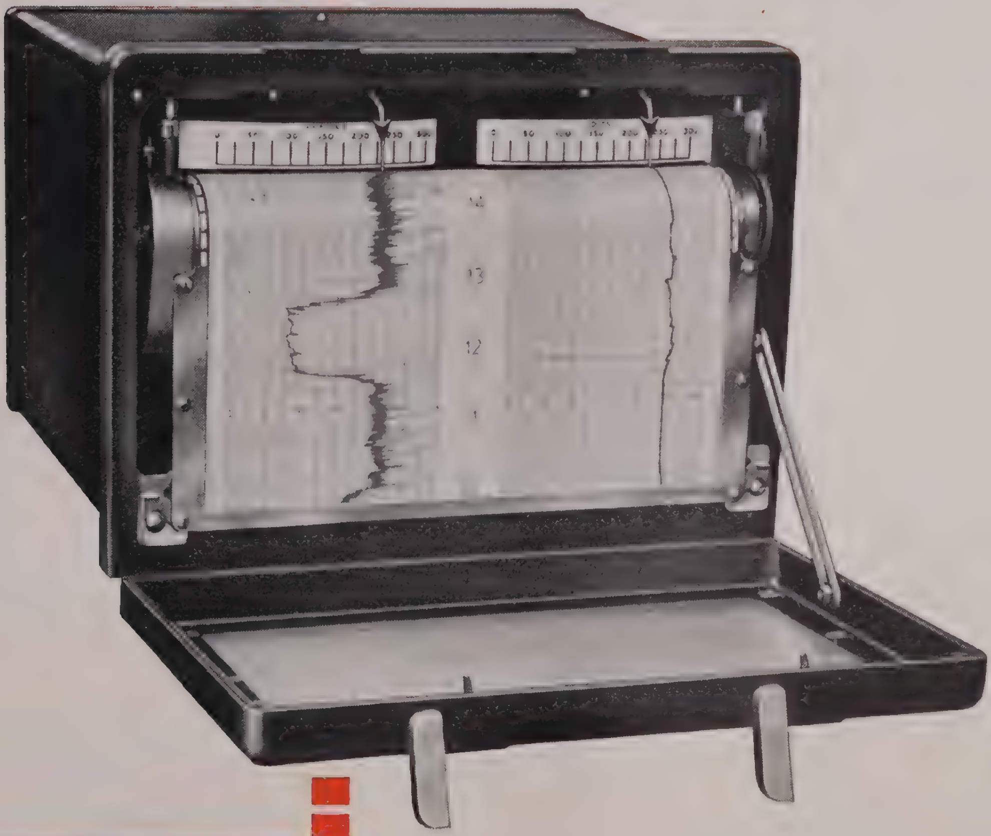

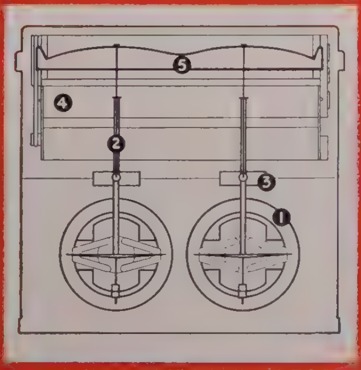

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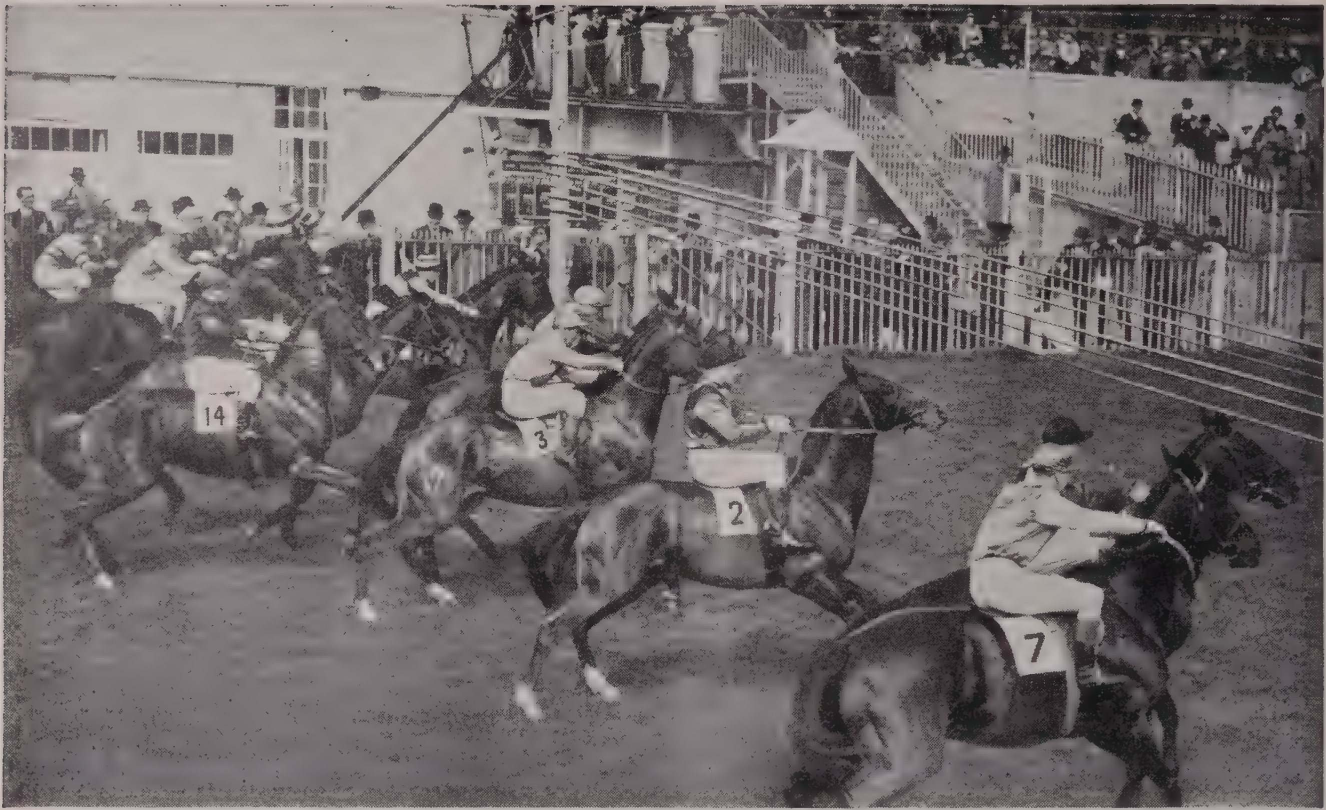

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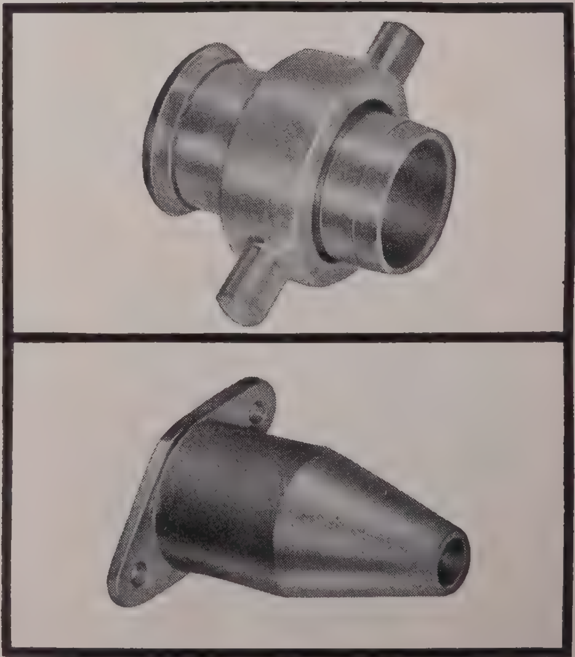

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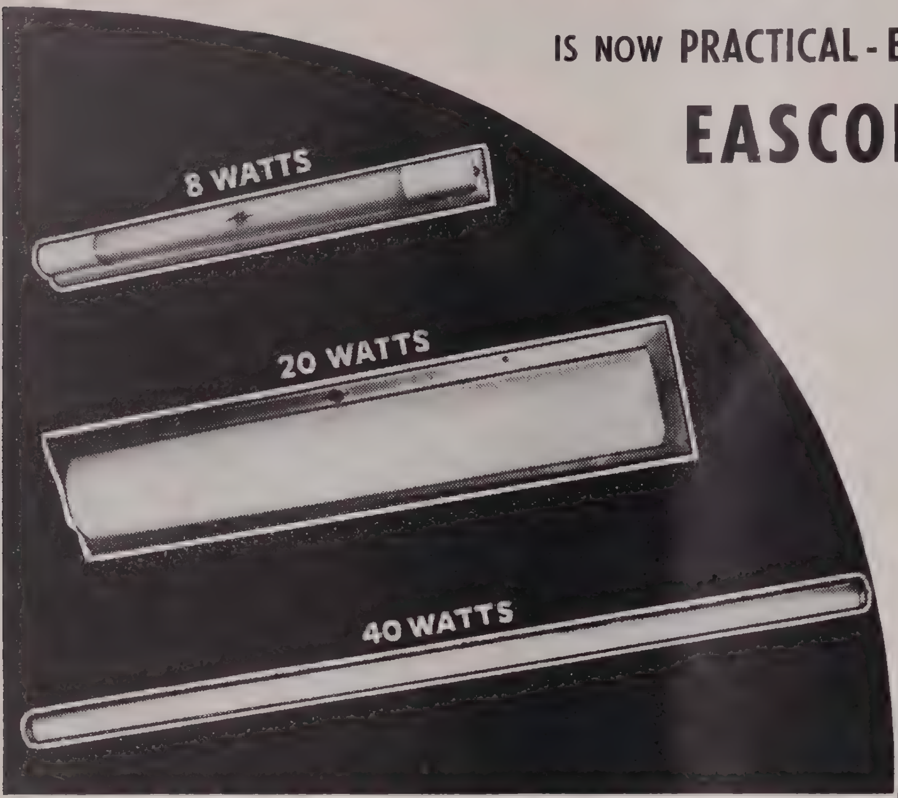

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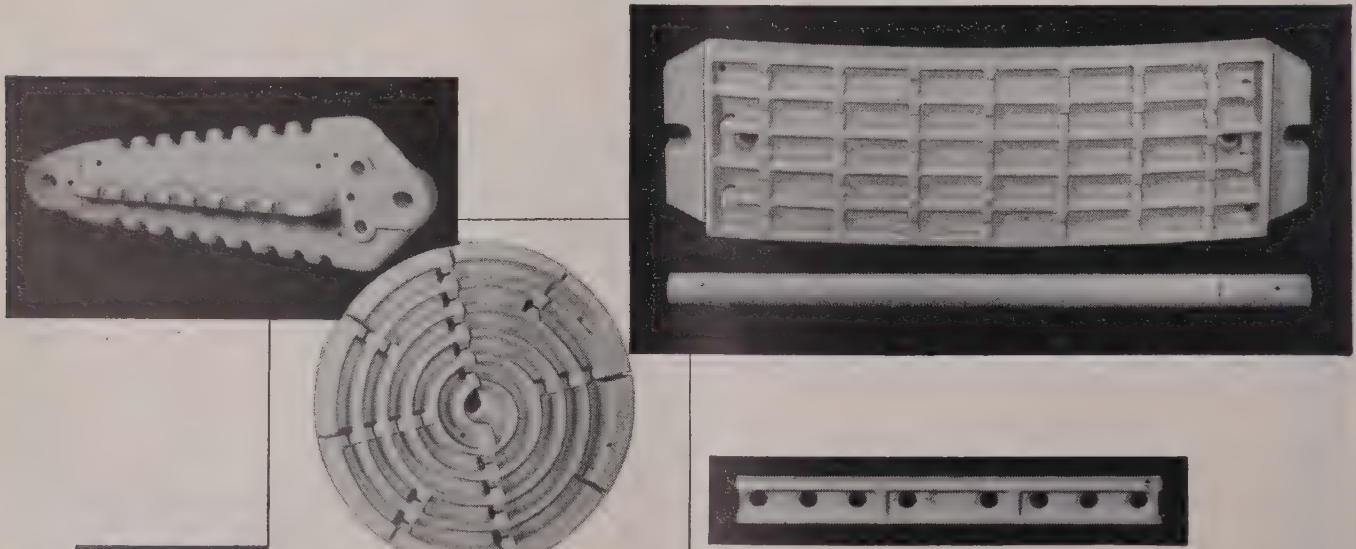

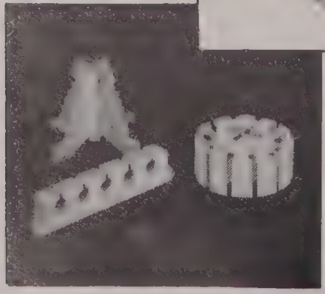

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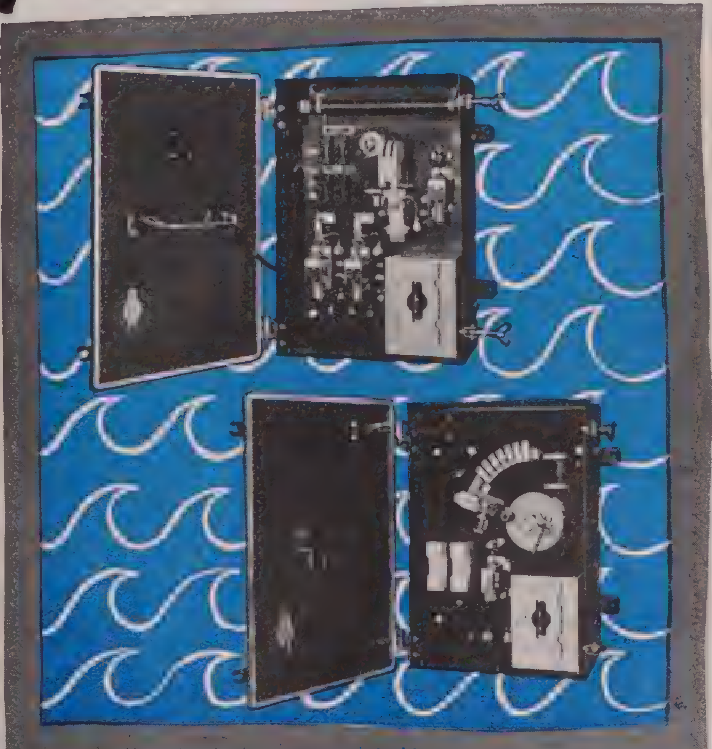

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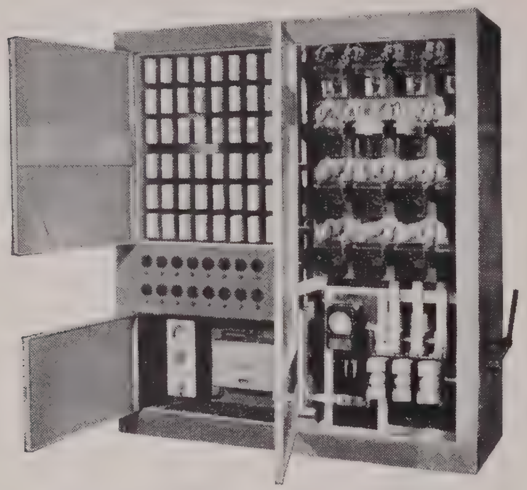

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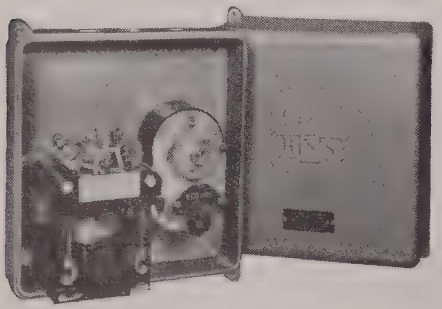

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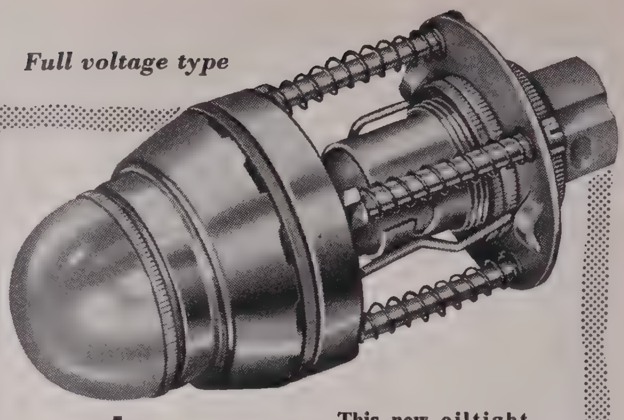

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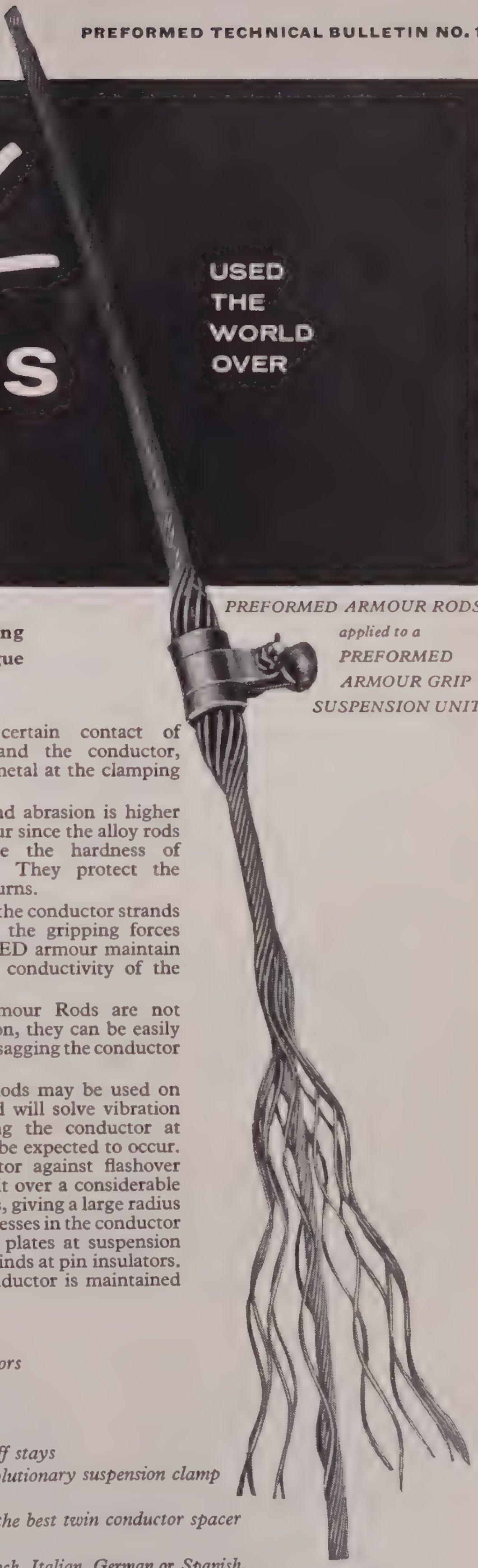

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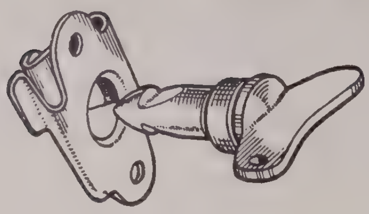

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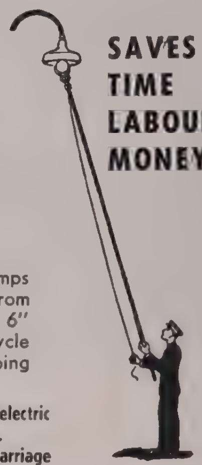

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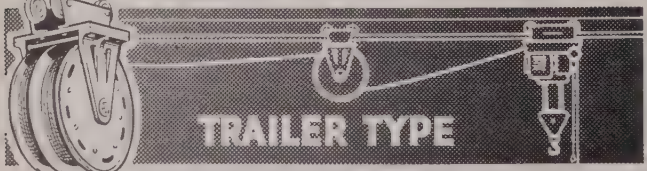

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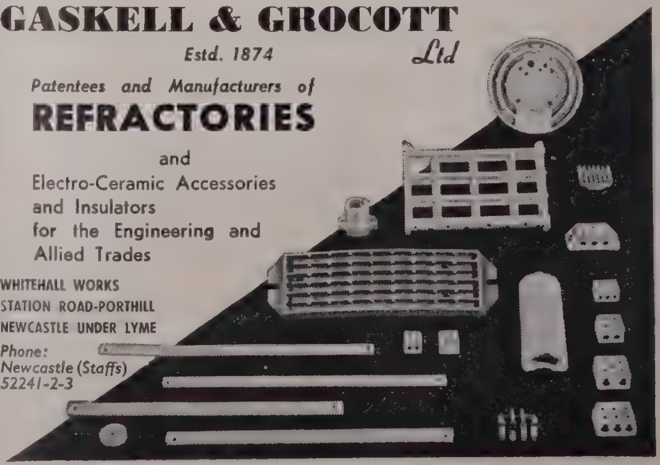

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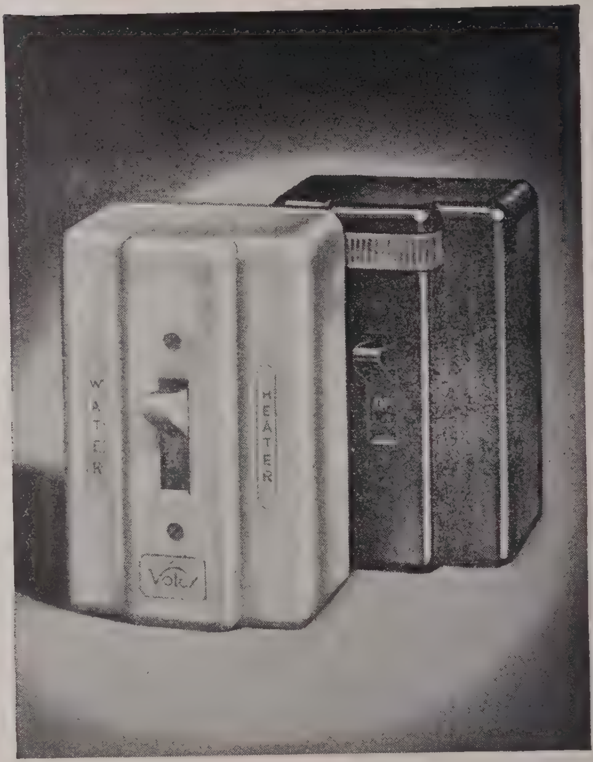

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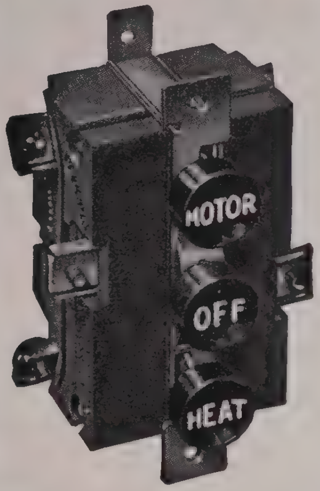

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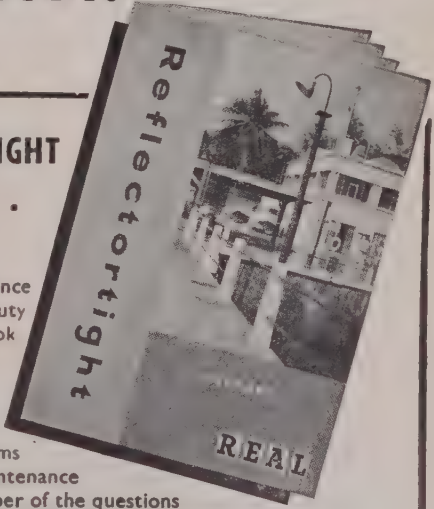

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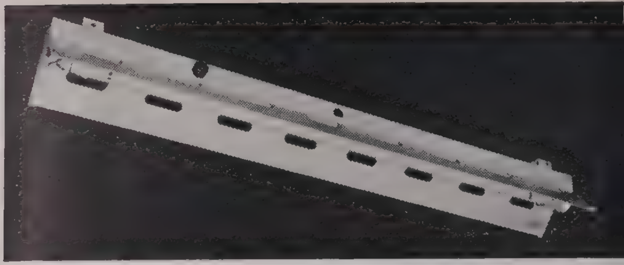
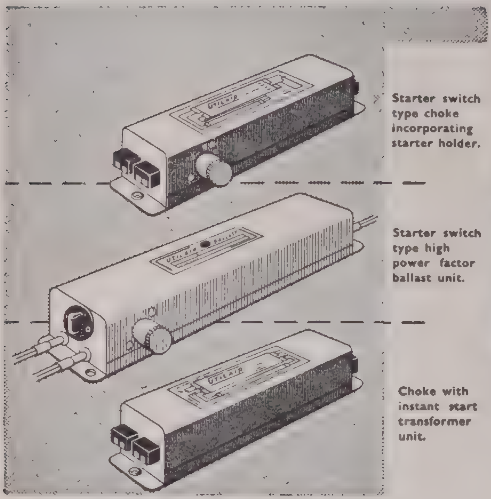


Model SSV.80 Industrial metal trough—slotted top



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Starter switch type high power factor ballast unit.

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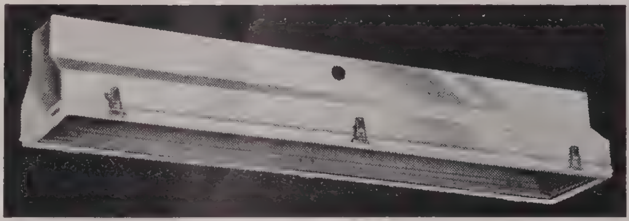

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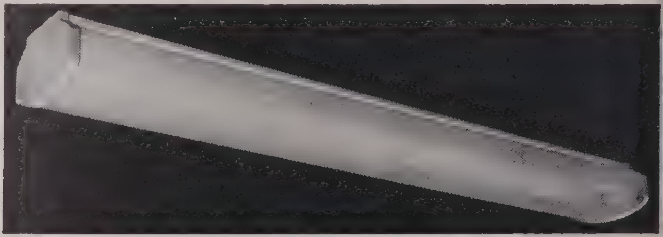

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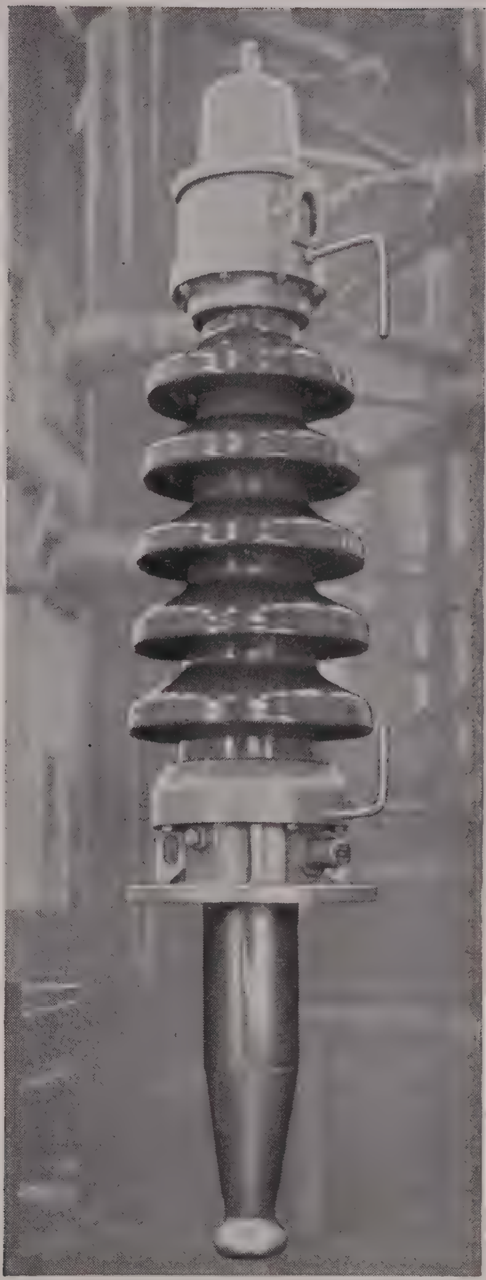

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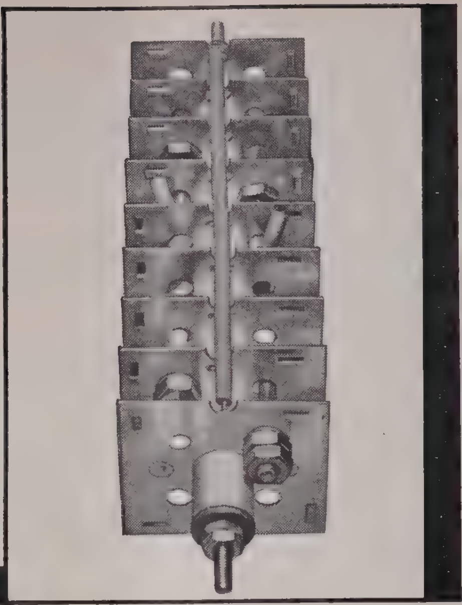
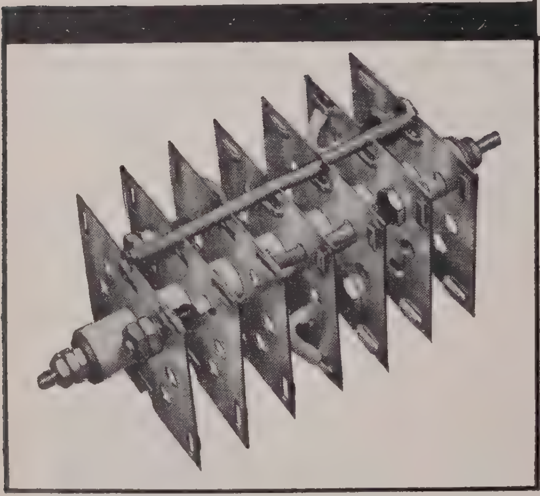


SenTerCel



silicon rectifier stacks

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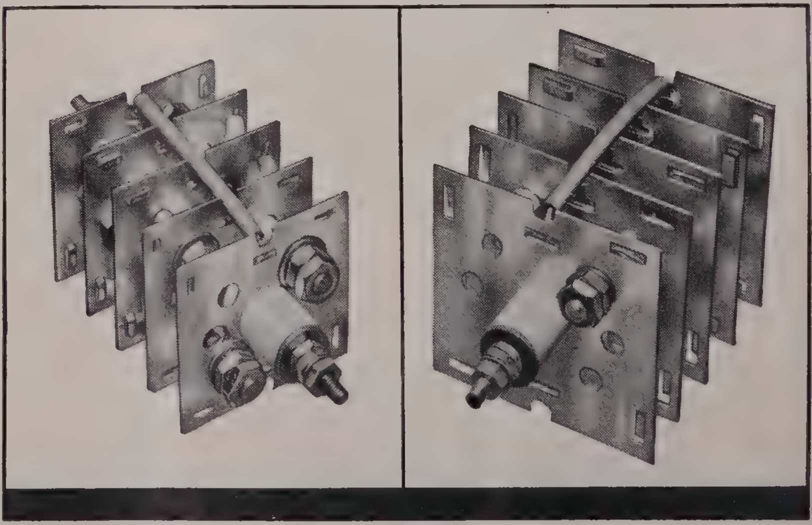

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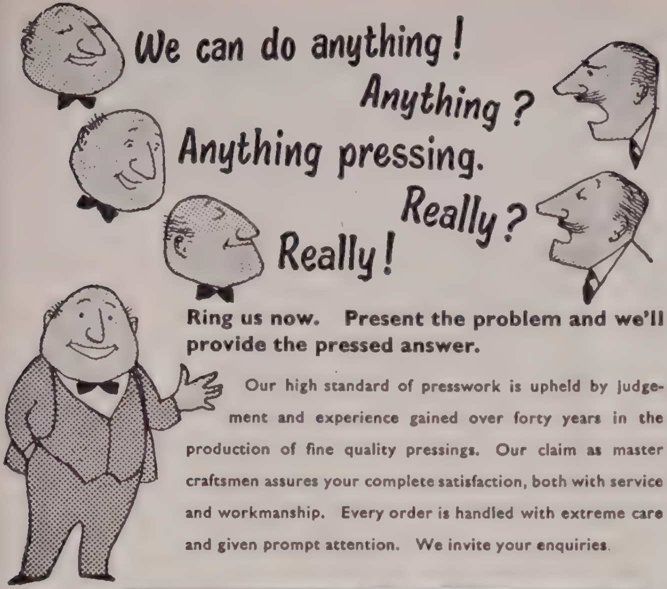
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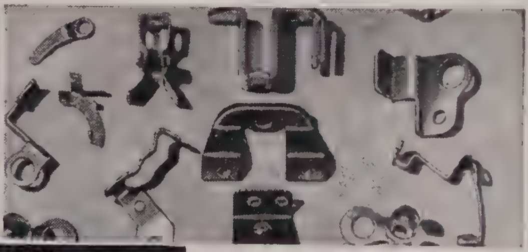

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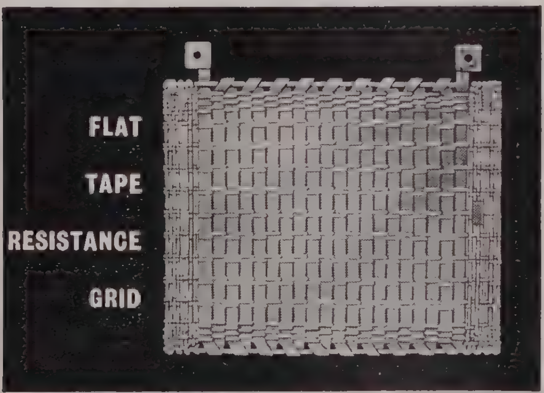

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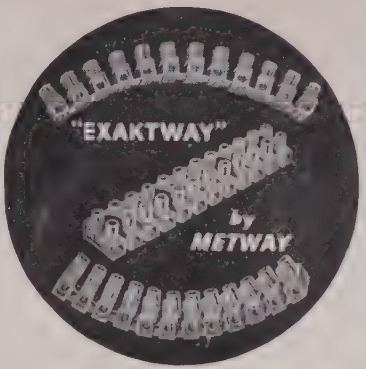

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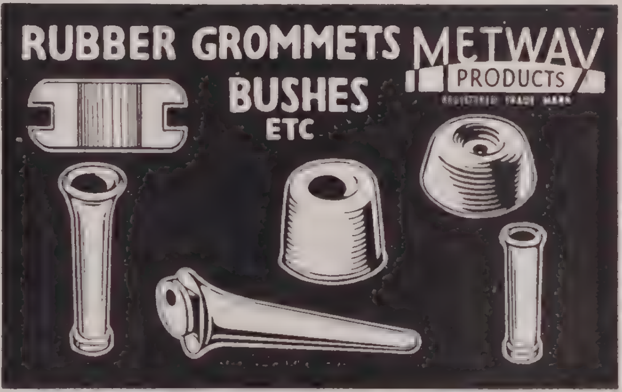

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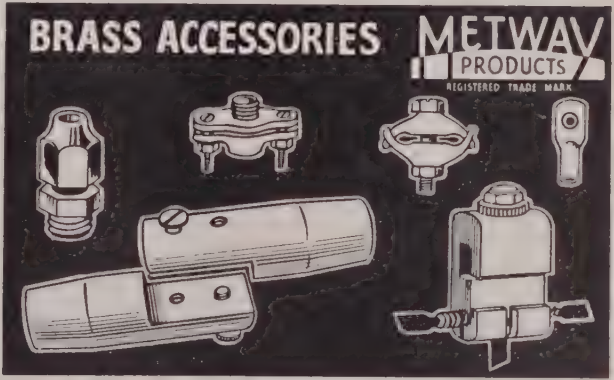

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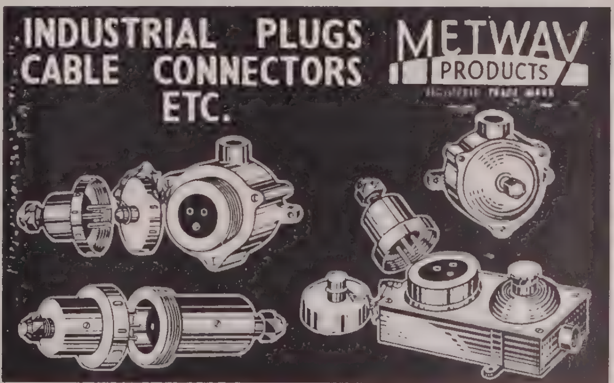

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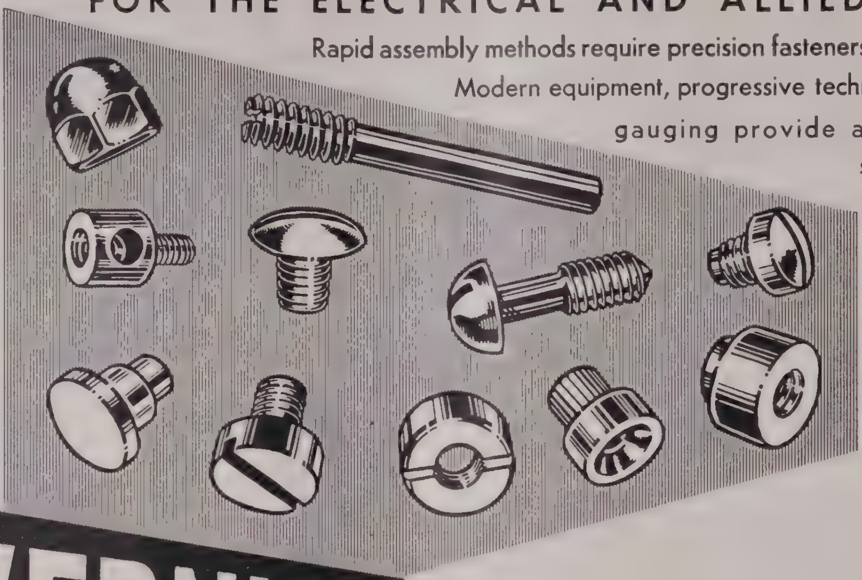

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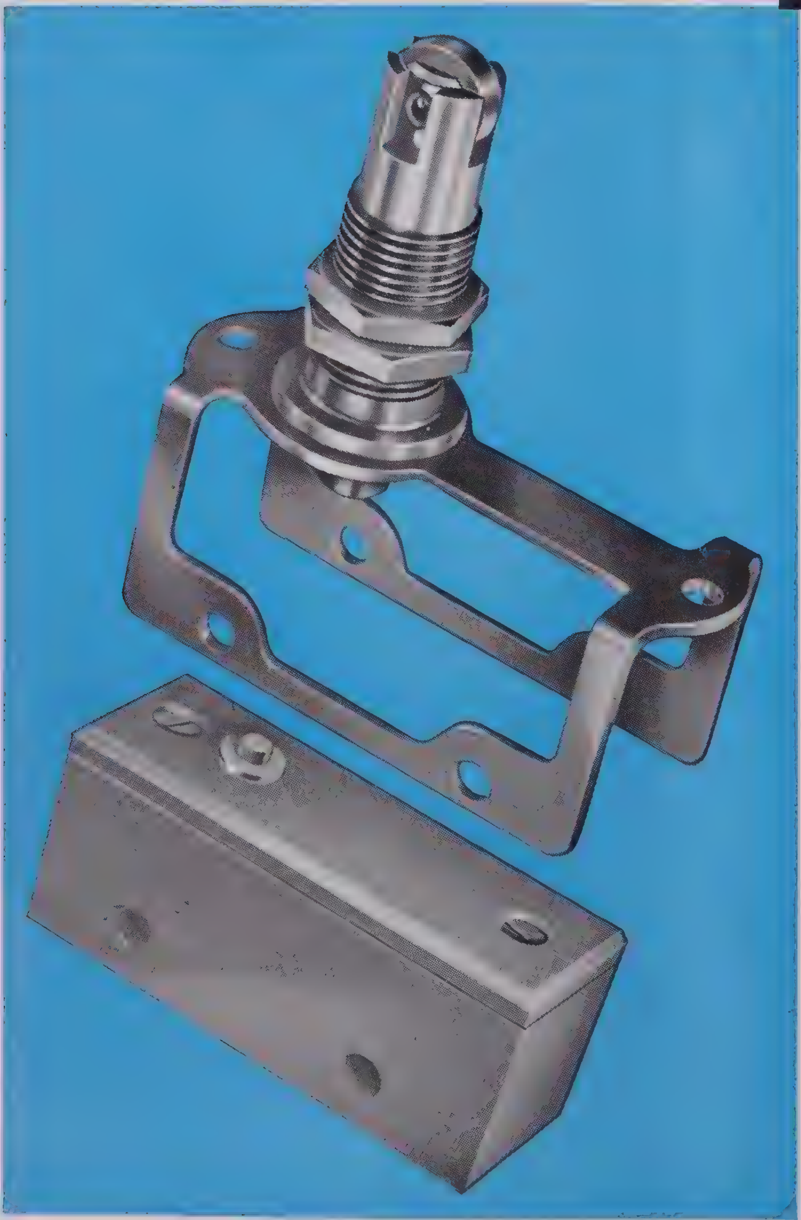

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SPECIFICATION

Single-pole snap action changeover switch.
Current rating: .... 1 amp at 29 volts D.C.
Inductive load: .... 5 amps at 250 volts 50 c/s A.C.
Plunger pre-travel: .... 1/16th″
Over-travel: .... 1/16th″
Differential movement: .... 0.030″
Plunger load: .... 3.5lb. nominal.
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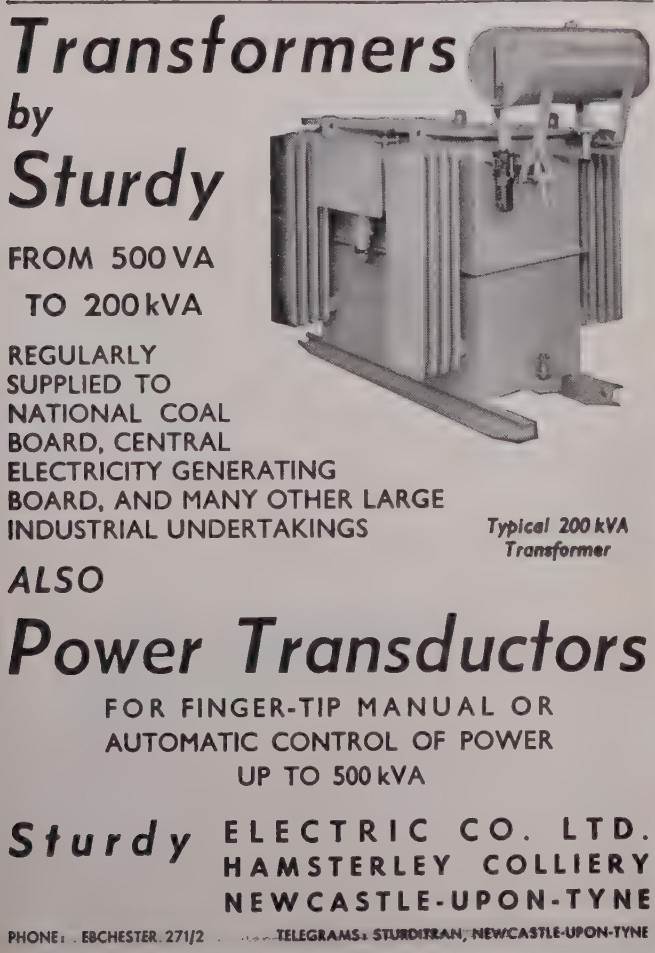

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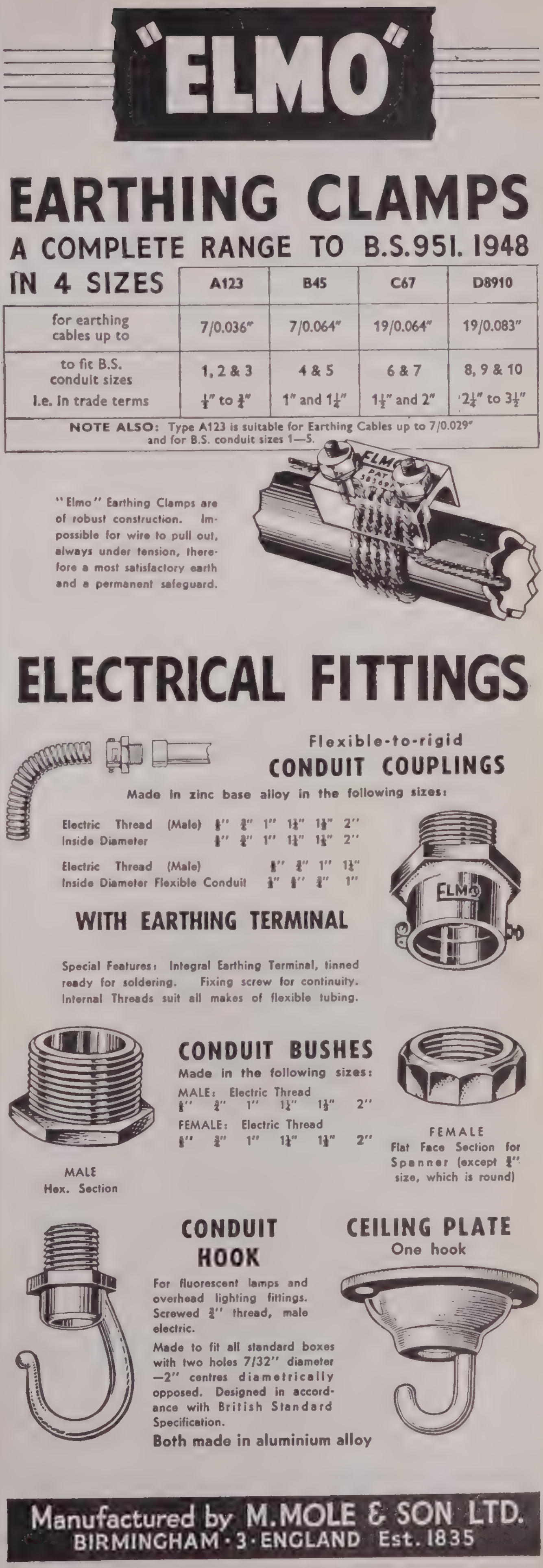

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A COMPLETE RANGE TO B.S.951. 1948

IN 4 SIZES	A123	B45	C67	D8910
for earthing cables up to	7/0.036"	7/0.064"	19/0.064"	19/0.083"
to fit B.S. conduit sizes	1, 2 & 3	4 & 5	6 & 7	8, 9 & 10
i.e. in trade terms	½" to ¾"	1" and 1¼"	1½" and 2"	2¼" to 3½"

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Inside Diameter	⅝"	¾"	1"	1¼"	1½"	2"

Electric Thread (Male)	⅝"	¾"	1"	1¼"
Inside Diameter Flexible Conduit	½"	⅝"	¾"	1"

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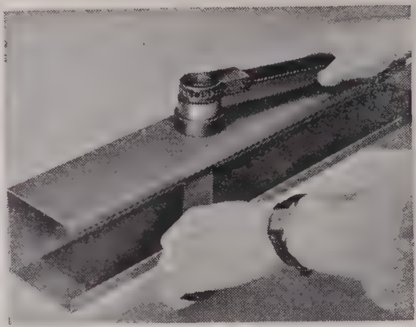

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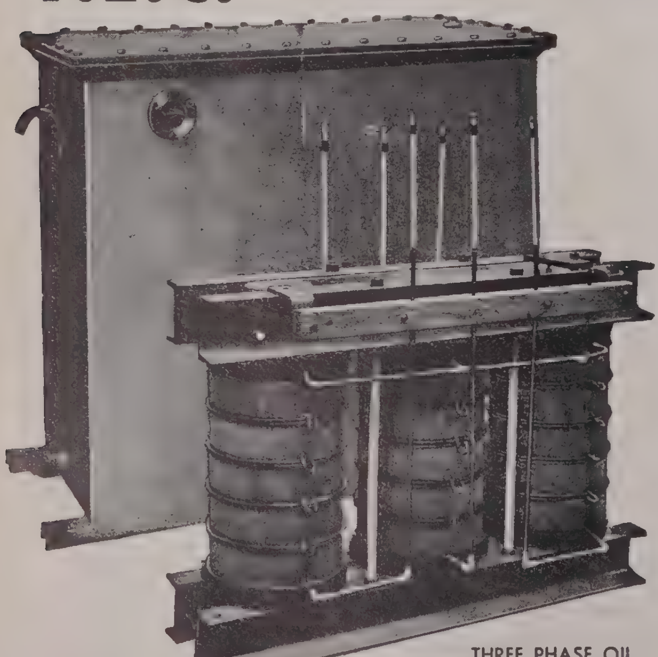

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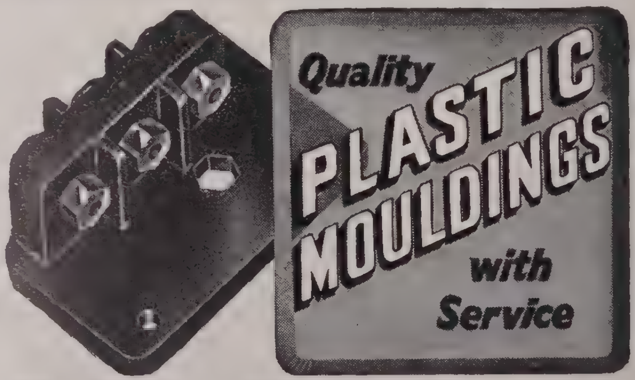

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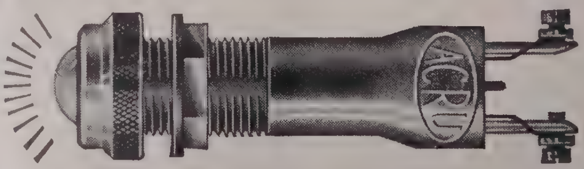

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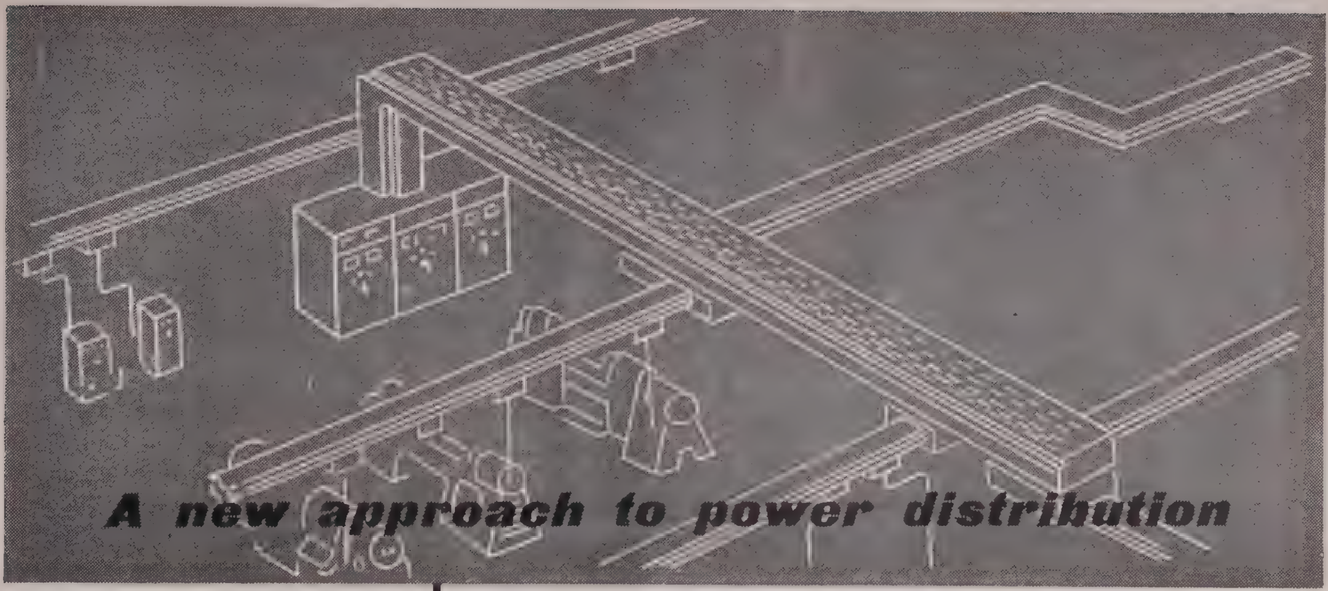
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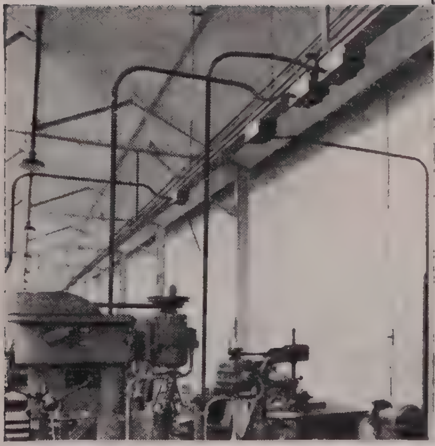

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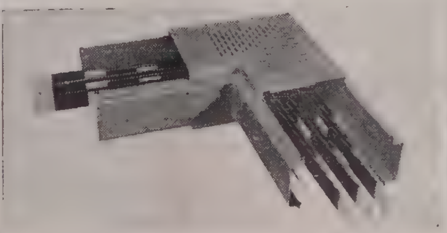
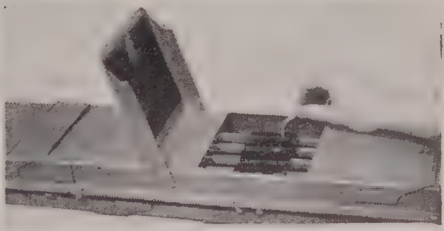


Corner section of heavy current trunking of 1,500 amps rating showing interleaved busbars.



Method of joining sections of British Canalis Universal.

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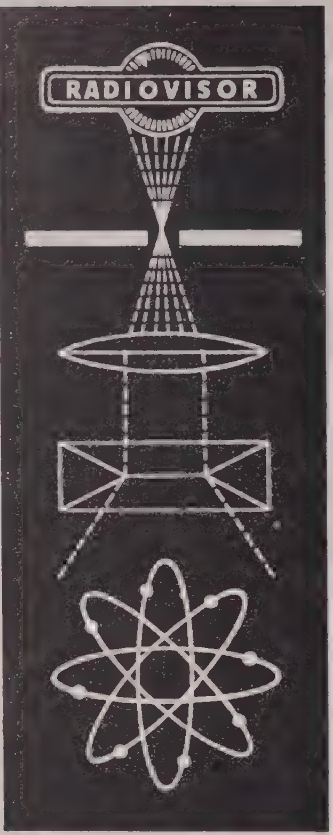

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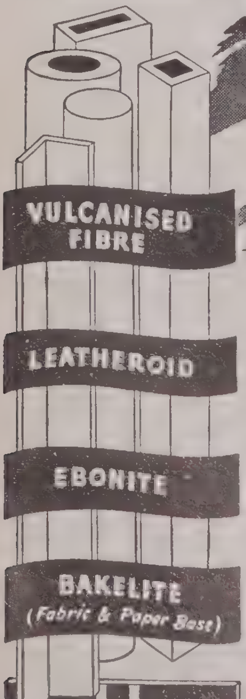

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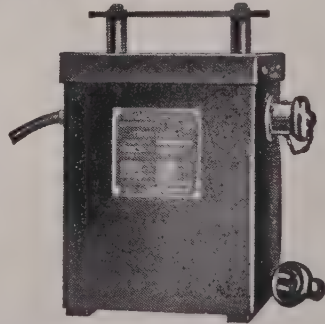

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SELL THE WATER HEATERS THAT CATCH A WOMAN'S EYE—Berry's

Husbands pay, of course, and make knowing noises when you talk of lagging and thermostatic control and B.S.S. 843. It's the least they can do. But when you come right down to it, this is a kitchen feature, and it has to please the head of that department. Which is only right, considering how much of her life she is going to spend with it. Instant hot water she must have—at the turn of a tap—and how much nicer if it comes from a sleek, smooth shape in one of four attractive finishes. From a Berry's A.Q./3 in fact.

A.Q./3. Capacity: 3 gallons.
In white, cream, pastel blue, pastel green.
1kW (A.C.) £14.6.0. Tax paid.
2kW (A.C.) £14.18.0. Tax paid.

A.Q./1½. Capacity: 1½ gallons.
In white, cream, pastel blue, pastel green.
1kW. (A.C.) £13.0.0. Tax paid.

Berry's 'A.Q' water heaters are most efficiently lagged and are fitted with thermostatic control. All tests and general performance comply with B.S.S. 843.

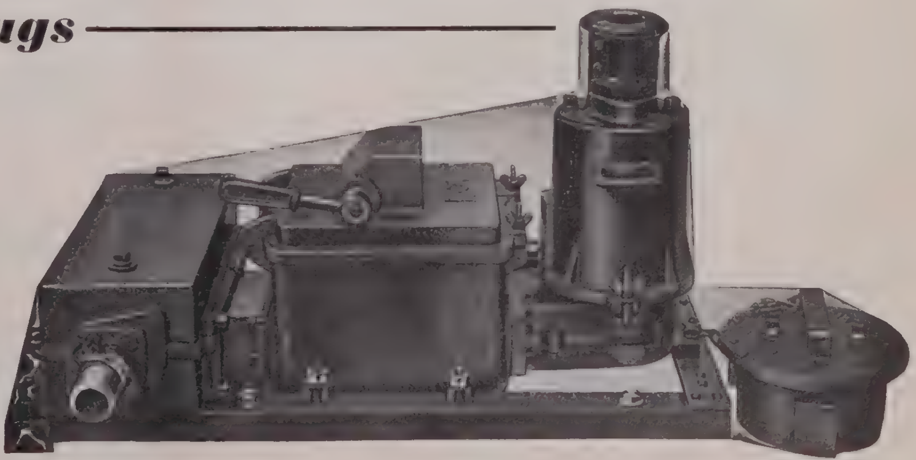
Berry's

BERRY'S ELECTRIC MAGICOAL LTD

Touchbutton House, Newman Street, London, W.1. (MUS. 6800)

Watertight Plugs and Sockets for Outdoor Crane Work

There are several arrangements of Weekes' W/T Plugs and Sockets and one of the modified forms is that designed for use with a travelling crane.



This dock plug is for installation in a pit, or on ground level

The travelling crane passes directly over the plug and socket, and the slack in the flexible trailing cable is wound on a drum, thus making it unnecessary to un-plug and re-connect when the crane passes the plug point. The plug and socket swing through a maximum angle of 220°.

All designs of Weekes' Watertight Plugs and Sockets can be made in ratings up to 300 amps. 500 volts, with two, three or four contact pins.

Advise us of your requirements; we can probably meet every one of them.

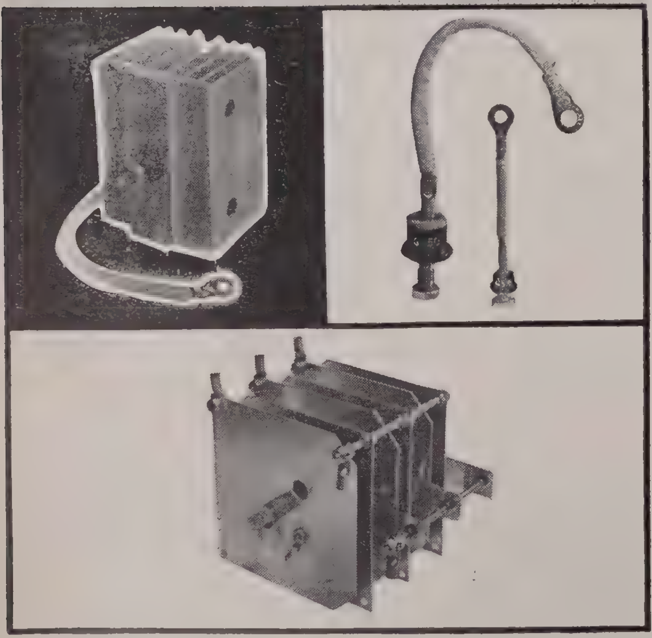
L. WEEKES (LUTON) LIMITED

WINGATE ROAD, LUTON, Beds.

TELEPHONE: LUTON 51478

SEMICONDUCTOR

POWER RECTIFIERS



J. STONE & COMPANY (DEPTFORD) LIMITED now offer Semiconductor power rectifier cells of 10 amp. and 50 amp. rating with absolute maximum P.I.V. up to 400 volts.

These cells have an extremely low forward voltage drop making possible rectification efficiencies in excess of 99%. Assembled stacks of 10 amp. cells giving all normal arrangements can be provided.

J. STONE & CO. (DEPTFORD) LTD.

ARKLOW ROAD, LONDON, S.E.14

further information on request from

STONE PLATT GROUP

CRAWLEY WORKS GATWICK ROAD CRAWLEY SUSSEX

P.O. Box 8 Hazelhurst Works, RAMSBOTTOM, Manchester
Telephone: Ramsbottom 2213/4/5 *Telegrams:* "SIMS" Ramsbottom
London Office and Stores:
106 Newlands Park, Sydenham London S.E. 26
Telephone: SYDenham 4211/2

S 52

Mercury switches

THE MERCURY SWITCH MANUFACTURING COMPANY LIMITED are the largest specialised manufacturers of Mercury Switches in Great Britain. These are made to exceptionally high and uniform standards of quality.

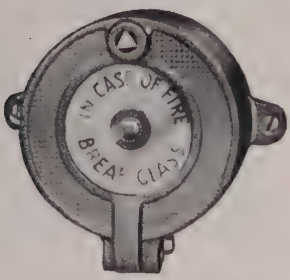
Since its inception in 1932, this Company has concentrated solely on the production of Mercury Switches. It has thereby obtained the widest possible experience and expert knowledge of design manufacture and application.

THE MERCURY SWITCH
MANUFACTURING COMPANY LIMITED
WEST DRAYTON + MIDDLESEX
West Drayton 3157

MS 12

Fire

Contractors—this is **your** business! **Profitable business** can be obtained by installing Gents' Fire Alarm Systems. Efficient, reliable and economical, simple systems are easily installed which comply with the Factory Act. Where necessary the free services of our Technical experts are available for surveying the premises.



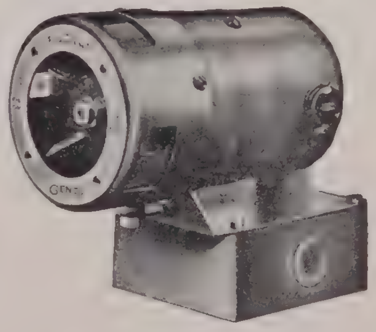
Typical Fire Alarm Contact

Specially designed as a neat, small Fire Alarm Point, with precious metal contacts and substantial springs for **complete** reliability even after years of installation. Each contact will operate a maximum of 3 Strident syrens on 200/250v AC.

PRICE £2. 10s. 0d.

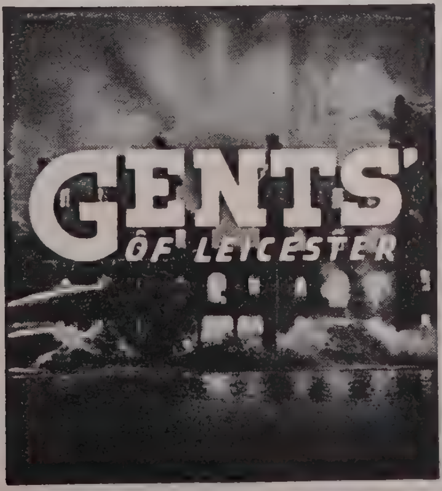
The "Strident" syren is ideal as a Fire Alarm signal and overcomes most noise levels. Only takes ¾ amp with consequent saving in wiring and current consumption. Totally enclosed motor for indoor use only, continuously rated. Base box drilled for ¾" conduit fitted with knockouts and can be turned through 90° to conform to conduit run.

PRICE 200/250 volts AC/DC (¾ amp consumption) **£7. 0. 0.**
24 volts DC (2 amp consumption)



The "STRIDENT" Syren

Alarms



Our informative booklet "Are You Protected?" will give you further information on installing Gents' Fire Alarm Systems together with sample schemes. Write for your free copy without delay.

FIRE ALARM SYSTEMS

GENT & COMPANY LTD · FARADAY WORKS · LEICESTER
London Office & Showroom : 47 Victoria Street, London S.W.1.

Branches also at:
BELFAST
BIRMINGHAM
BRISTOL
EDINBURGH
GLASGOW
NEWCASTLE

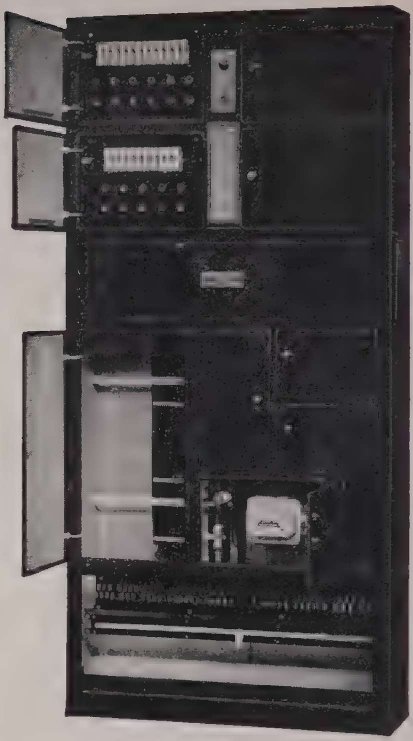
AEROFLEX

Fluvent

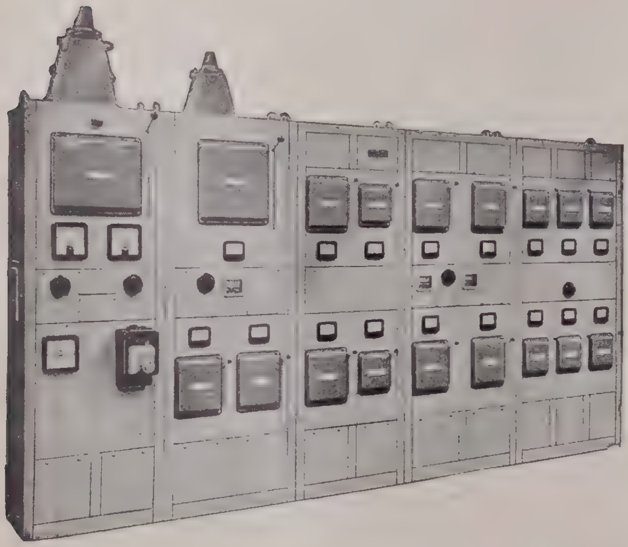
CUBICLE TYPE

SWITCHBOARDS

The name FLUVENT has been associated with advanced Switchboard design since the beginning of the century and the name AEROFLEX has been synonymous with high breaking capacity Fuses since they were first introduced in the early 1920's.



An unusual Cubicle Board (right) which provides a variety of lighting fuseboards with tumbler switch panels. It is installed in St. George's Chapel, Windsor.



Installed in a modern manufacturing undertaking, this Board (above) protects one 300 amp. eight 100 amp. and eight 60 amp. 3 phase 4 wire outgoing circuits, and the incoming Cubicle on the left is provided with a 600 amp. main switch and metering facilities.

A compact Board (right) protecting one 300 amp. and two 60 amp. 3 phase 4 wire circuits and six 30 amp. single phase and neutral circuits, all under the control of a 600 amp. T.P. and Neutral incoming main switch.

Publication SB3 illustrates and describes a selection of Cubicle and Unit Type Switchboards. A copy will be forwarded to you on request.

Parmiter Hope & Sugden Ltd.

FLUVENT ELECTRICAL WORKS · LONGSIGHT · MANCHESTER 12

London: 34 Victoria Street, S.W.1. Glasgow: 5 Somerset Place, C.3. Birmingham: 39/41 Carrs Lane, 4.

dmPH149

Classified Advertisements

CLASSIFIED advertisements are PREPAID at 3/6 per line (approx. 6 words).

DISPLAYED CLASSIFIED:—48/- per single column inch.

Where an advertisement includes a Box Number there is an additional charge of 1/-.

SERIES DISCOUNTS for consecutive insertions:—13, 5%: 26, 10%: 52, 15%.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

REPLIES TO BOX NUMBERS should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. If an applicant for a situation appearing under a Box Number does not wish his reply to be forwarded to a particular firm or individual instructions to this effect should be addressed to the Advertisement Supervisor, ELECTRICAL REVIEW. The name of an advertiser using a Box Number cannot be disclosed.

OFFICIAL NOTICES, TENDERS, ETC.

N.A.T.O. UNCLASSIFIED

N.A.T.O. COMMON INFRASTRUCTURE SLICE VII

NAVAL BASE INSTALLATIONS

FINAL Notice is hereby given that International Competitive Bids will be invited on or about 3rd August, 1960, for the supply and installation of the complete electrical installation for a P.O.L. Storage Depot to be constructed at Rosneath, in the Dumbartonshire area of Scotland. The system will be 415-volt, 3-phase, 4-wire, 50-cycles.

2. The approximate total value of the works is £10,000 and the contract will comprise flameproof and industrial equipment for the following purposes :—

- Power distribution and control, including switchgear, cables and starters.
- Lighting of roads, tankage areas, buildings and jetty.
- Heating of buildings.
- Cathodic protection of jetty.
- Earthing and bonding.

3. The work will be carried out as one contract which will be undertaken as a sub-contract within the framework of the main contract for the construction of the depot.

Bids for the main contract have been invited.

4. It should be noted that the importation of labour from sources outside the United Kingdom may be subject to restriction and that permission could, in any case, only be given on an undertaking that the contractor would pay rates of wages and observe hours and conditions of labour not less favourable than those established for U.K. labour for the trade or industry in the same area.

5. The closing date for the receipt of bids will be 7th September, 1960.

6. Firms wishing to bid must formally notify their desire by application to the address below by 22nd June, 1960.

7. Within one week of the closing date for the receipt of applications to bid firms wishing to be invited must forward the following information :—

(i) Statement of financial resources and evidence of financial stability.

(ii) Details of recent major contracts completed for work of comparable nature, including an indication of the value of each.

8. Enquiries regarding bidding should be addressed to :—

Director-General, Navy Works,
Admiralty,
Chamberlain Way,
Pinner, Middlesex,
England,

quoting reference D.G.N.W./INFRA/8, ELECTRICAL SUB-CONTRACT.
4706

CLASSIFIED ADVERTISEMENTS ARE PREPAID

BOROUGH OF KETTERING

Street Lighting

TENDERS are invited for the provision of 81 400-watt and 59 250-watt Mercury Vapour Lighting units on Steel Columns in connection with street lighting improvements within the Borough.

Tenderers may quote for:—

(a) The supply only of Lanterns auxiliary gear and lamps.

(b) The supply of Columns with erection, wiring and fitting of electrical equipment supplied by another firm.

(c) The whole of the work.

General conditions of contract and plans may be inspected, and specifications, bills of quantities and forms of tender obtained from the Borough Engineer and Surveyor's Office, 3, Gold Street, Kettering, on payment of a deposit of £2 2s., which will be refunded on receipt of a bona fide tender and the return of all documents.

Tenders in plain sealed envelopes endorsed "Street Lighting" must be delivered to the undersigned not later than noon on Thursday, 30th June, 1960.

The Council do not bind themselves to accept the lowest or any tender.

D. DUNSFORD PRICE,
Council Offices, Town Clerk.
Huxloe Place, Kettering. 4733

SADDLEWORTH URBAN DISTRICT COUNCIL

Street Lighting

TENDERS are invited for the supply and erection of 121 Lighting points in Contract No. 1 and 18 Lighting points in Contract No. 2 on specified roads within the Council's District.

The tenders to include for the provision and installation of concrete columns, bracket lanterns and auxiliary equipment, together with the necessary wiring.

Forms of tender, specification and bills of quantities may be obtained on application to Mr. G. H. Booth, Lighting Superintendent, Council Offices, Uppermill, Nr. Oldham.

Tenders in plain sealed envelopes, which must not bear any mark indicating the sender, endorsed "Street Lighting," addressed to the Clerk of the Council, Council Offices, Uppermill, Nr. Oldham, to be delivered before noon on Saturday, the 25th June, 1960.

The Council do not bind themselves to accept the lowest or any tender.

T. NUTTALL,
Council Offices, Clerk of the Council.
St. Chads,
Uppermill, Nr. Oldham. 4704

BOROUGH OF BATLEY

Street Lighting Department

TENDERS are invited for the supply of the following equipment :—

Sodium Lanterns, 140-watt.
Sodium Lanterns, 60-watt.
Control Gear for above.
140-watt Sodium Lamps and Jackets.
60-watt Sodium Lamps and Jackets.
Solar Dial Time Switches.
Wall Boxes and Back Plates.

Specification and form of tender may be obtained from the Borough Engineer, Hanover Street, Batley, and tenders, in a plain sealed envelope (not bearing any name or mark indicating the sender), endorsed "Tender for Street Lighting Equipment," must be delivered to the undersigned not later than 20th June, 1960.

The Corporation does not bind itself to accept the lowest or any tender.

L. O. BOTTOMLEY,
Town Clerk. 4705

WHITSUN

ADVERTISEMENTS for the issue of 10th June have now closed for press

Advertisements for 17th June issue are accepted up to **First Post on Monday, 13th June**

If displayed with boxed rules, name or symbol block by **Friday, 10th June**

All communications to be addressed to:
Classified Advertisement Department,
ELECTRICAL REVIEW
Dorset House, Stamford Street
London, S.E.1

Original testimonials should not be sent with applications for employment

SITUATIONS VACANT

See "Replies to Box Numbers" above)

AIR MINISTRY

STATION ENGINEERS (G.D.) and STATION ENGINEERS (Mech.) required at R.A.F. and Ministry of Aviation Stations. The work of Station Engineers (G.D.) consists of installation, operation and maintenance of high and medium-voltage electrical distribution systems, electrical power and lighting installations, control systems and generating plant; knowledge of heating and ventilating plant and diesel engines an advantage. Station Engineers (Mech.) are concerned with diesel power plant, steam and hot water heating systems, refrigeration and air conditioning and miscellaneous workshop plant, tools and equipment.

Candidates must hold O.N.C. Elec. or Mech./City and Guilds Electrical Technicians Certificates/ 2nd Class M.O.T. Certificate or equivalent, and must also have had recognised apprenticeship with firm of good repute plus 3 years' employment in electrical or mechanical engineering, preferably on operation and maintenance of mine, factory or workshops plant and services. Preference to candidate with supervisory experience.

Salary ranges from £680 to £785 rising by annual increments to £850. Commencing salary dependent upon age, qualifications and experience. Opportunities for promotion up to Tech. Grade A, maximum salary £1,565 (national rate). Pension prospects. 5-day week. 18 days' paid leave a year initially. Internal training courses are provided and attendance at technical colleges by suitable candidates is sponsored. Overseas tours for which special allowances are payable in addition to higher salary.

Applicants, who must be natural-born British subjects, up to age 35, should write stating age, qualifications and experience to Manager (P.E.1), Ministry of Labour, P. & E. Register, Atlantic House, Farringdon Street, London, E.C.4. No original testimonials should be sent. Only applicants selected for interview will be advised. 266

MINISTRY OF LABOUR

H.M. Electrical Inspector of Factories

PENSIONABLE post at Manchester for man or woman at least 35 on 1st April, 1960, with Corporate Membership of I.E.E. and several years' professional experience. Candidates should preferably hold a university degree in electrical engineering. Responsible experience in electrical supply, electrical manufacturing works or large industrial electrical installation an advantage.

Salary scale (men) £1,550 (lower if under 40) to £2,070. Exceptionally starting pay may be above minimum. Promotion prospects.

Write Civil Service Commission, 17, North Audley St., London, W.1, for application form, quoting S/5138/60. Closing date 7th July, 1960. 4685

Situations Vacant (continued)

CITY OF SALISBURY (SOUTHERN RHODESIA)

Vacancy for Electrical Engineer (Distribution)

Salary Scale £1,025 × £102 10s. to £1,332 10s. × £76 17s. 6d. to £1,563 2s. 6d. × £51 5s. to £1,768 2s. 6d. per annum

APPLICATIONS are invited for the Fixed Establishment post of ELECTRICAL ENGINEER (Distribution in the Salisbury Municipal Electricity Department, on the scale £1,025 × £102 10s. to £1,332 10s. × £76 17s. 6d. to £1,563 2s. 6d. × £51 5s. to £1,768 2s. 6d. per annum. No allowances are payable.

Commencing salary is based on qualifications and experience, with a barrier at £1,563 2s. 6d. per annum, above which no engineer can rise without being a Corporate Member of the British Institution of Electrical Engineers, and £1,614 7s. 6d. per annum is the maximum entry point into the grade.

Candidates must be graduates of the British Institution of Electrical Engineers and/or hold an equivalent electrical engineering degree.

Experience in the design and planning of distribution networks and substations from L.T. 11 kV and up to and including 33 kV, the preparation of technical specifications and the compiling of investigatory reports on general distribution problems, together with general experience on mains and substation construction works on a large undertaking is essential.

The person appointed may be required to undertake standby duties on a roster of approximately one in five, for which payment at the rate of £5 5s. per week of duty will be made.

The appointment will be subject to the City Council's service and leave regulations. The successful candidate will be required to furnish to the Council a satisfactory medical certificate of fitness and to serve a probationary period of not less than six months, and if thereafter confirmed in his appointment, to join the Southern Rhodesia Local Authorities' Joint Pension and Widows' and Orphans' Fund. He must also be able to comply with the requirements of the Federal Immigration Authorities.

Candidates must submit full particulars of their qualifications, training and experience, giving details of positions held and salaries received. Age, place of birth, nationality and marital status should be stated and copies of not more than three recent testimonials may be forwarded.

Particulars of the undertaking and a summary of conditions of service, pension and leave entitlements, etc., may be obtained from Messrs. Davis & Soper Ltd., 52-54, St. Mary Axe, London, E.C.3, to whom applications must be submitted on or before 18th June, 1960.

4591

HOSPITAL DESIGN ENGINEERS

EXPANSION OF BUILDING PROGRAMME

NORTH WEST METROPOLITAN REGIONAL HOSPITAL BOARD

PROFESSIONAL ENGINEERS required for the staff of the Regional Engineer, James Galloway, M.I.Mech.E., M.I.E.E., M.I.H.V.E.

The posts are permanent and pensionable and offer considerable career prospects owing to the vast expansion of the hospital building programme. Those appointed will be members of a team designing the engineering services for new hospitals, extensions, etc.; they will work under the general control of an experienced professional engineer, but they will themselves be responsible for the design and management of individual schemes. The work is complex in nature and extremely interesting and offers a challenge to the engineer who wants more than the usual run of job.

Applicants should be A.M.I.Mech.E. or A.M.I.E.E. or A.M.I.H.V.E., but graduate members of these Institutions will be accepted provided that in the case of the Institution of Heating and Ventilating Engineers they have passed Sections A and B of the Institution examination.

Salaries will be within the range of £910 to £1,600 plus £40-£50 London weighting. The minimum point of entry for Corporate Members of the major institutions is £1,160 plus £50 London weighting. A bar exists at £1,400 plus £50 beyond which it is necessary to be A.M.I.Mech.E. or A.M.I.E.E., and graduates do not proceed beyond £1,205 plus £50 until they have obtained Corporate Membership, when continuance up the scale is automatic.

It is expected that these posts will be accepted by the professional institutions as leading to Corporate Membership provided other conditions have been fulfilled. A scheme for study leave is in process of inauguration.

Apply, stating age, qualifications (with dates) and experience, with names of two referees, to the Secretary, North West Metropolitan Regional Hospital Board, 40, Eastbourne Terrace, London, W.2, quoting reference 823. Enquiries by telephone or visit by appointment to the Board's headquarters offices would be welcome.

Tel. AMBassador 8011, Ext. 330

4569

LONDON ELECTRICITY BOARD

Senior Sales Representative

APPLICATIONS are invited for the above position in the Commercial Department of the Board's Surrey Suburban District. The successful applicant will be based at Electricity House, Durnsford Road, Wimbledon, but will be required to work anywhere in the District, and may, from time to time, be called upon to undertake duties in the showrooms.

Applicants should have good sales ability and be thoroughly conversant with supply matters, tariffs, apparatus and sales to consumers with domestic or small commercial or industrial installations. The possession of the E.D.A. Salesmanship Certificate would be considered an advantage. They should be competent to lead a small team of representatives.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 3, i.e., £720 to £780 per annum, plus the appropriate London area allowance.

Application form obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2. Please quote ref. PER/V/2906/R.

4689

PERMACEL TAPES LIMITED

require

PRODUCT MANAGER

for the development and promotion of Pressure Sensitive Electrical Tapes

The successful applicant should be between the age of 30 and 40 years and have a sound basic knowledge of electrical engineering and experience in advertising and marketing to the industry. Experience in the Pressure Sensitive Tape field would be a great advantage but not essential.

Progressive position.
Four-figure salary (plus expenses).
Pension scheme (plus other benefits).

Full details of age, experience and qualifications to:—

THE MARKETING MANAGER
PERMACEL TAPES LIMITED
260, BATH ROAD, SLOUGH, BUCKS
A Johnson & Johnson Company

4711

CENTRAL ELECTRICITY GENERATING BOARD

Power Station Superintendent, Dungeness Power Station

Eastern, London and South Eastern Region
(Staff Vacancy Notice 11/60)

APPLICATIONS are invited for the appointment of POWER STATION SUPERINTENDENT at Dungeness Nuclear Power Station.

Applicants should have a thorough technical and practical training followed by wide experience in the operation and maintenance of modern power station plant. Importance is attached to the financial and human relations aspects of such operation, and the successful candidate would be expected to have vision and adaptability to new ideas.

Applicants should preferably possess a university degree in relevant subjects and be Corporate Members of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers. Whilst knowledge of nuclear operations is desirable, this is not essential as suitable training can be given.

After receiving any nuclear training considered necessary the successful candidate would be required to spend a period of approximately twelve months in the post of Chief Assistant Engineer to the Nuclear Operations Engineer at Board Headquarters, Friars House, London, S.E.1, after which he would proceed to site.

The salary for this post will be £3,000 per annum.

Applications, quoting Vacancy No. 11/60, experience, present position and salary, should be forwarded to the Regional Secretary, Eastern, London and South Eastern Region. Ergon House, Horseferry Road, Westminster, London, S.W.1, not later than the 14th June, 1960.

4678

DOWDING & MILLS LTD. BORDESLEY, BIRMINGHAM, 12

the industrial electrical and mechanical repair specialists, seek the services of an ENGINEER REPRESENTATIVE TO OPERATE FROM THEIR NEW BRANCH AT SOUTHAMPTON.

Experience of electric motor manufacture and repair desirable, together with a knowledge of metal spraying.

Basic salary, bonus, superannuation scheme, and company car provided.

Applications to the Southern Area Sales Manager, Dowding & Mills Ltd., 24/26, White Post Lane, London, E.9.

4732

Engineers and Draughtsmen

A large scale programme is being planned, which will include the building of several new hospitals together with additions and alterations, etc., throughout Wales and Monmouthshire—work which offers great scope for personal experience and advancement. In all cases preference will be given to candidates who have had previous experience in the design, estimating and installation of the appropriate engineering services in hospitals or large buildings

WELSH REGIONAL HOSPITAL BOARD BUILDING PROGRAMME PRESENTS OUTSTANDING OPPORTUNITIES

POSITION VACANT	QUALIFICATIONS	SALARY SCALE
(a) MECHANICAL and ELECTRICAL ENGINEERS, GENERAL GRADE (including one fuel efficiency engineer).	Corporate or Graduate members of the Institution of Civil, Mechanical, Electrical or Heating and Ventilating Engineers.	£910 × 35 (1) × 40 (2) × 45 (5) × 50 (7)—£1,600 Bar at £1,400 for I.H.V.E. men. Bar at £1,205 for graduate members of institutions. Corporate members of major institutions enter scale at £1,160.
(b) MECHANICAL and ELECTRICAL ENGINEERING ASSISTANTS.	Pass in sections 1 and 2 of the Examination of the I.C.E., I.Mech.E., or I.E.E., OR sections A and B of the Associate Membership Examination of the I.H.V.E., OR H.N. diploma OR H.N. Certificate OR a recognised engineering degree PLUS practical training and site experience.	£600 (age 21) × 25 (4) × 30 (5) × 35 (4) × 40 (2) — £1,070. £50 deduction where none of the specified qualifications are held and a qualification Bar at £920. Corporate members of major institutions enter at £850.
(c) ENGINEERING DRAUGHTSMEN.	Grades 1 and 2: H.N.C. or sections A and B of the I.H.V.E. Examination or equivalent qualification preferred.	Grade 1: £1,030 × 35 (2) × 50 (3) — £1,250.
		Grade 2: £870 × 35 (4) — £1,010.
	Grade 3: 3 years' practical and theoretical training including site or workshop experience and technical experience in engineering drawing.	Grade 3: £550 × 25 (2) × 30 (6) × 35 (2) —£850.

MODERN OFFICES

Newly built modern offices in Cardiff's City Centre. Five day week. All posts are superannuable.

LIVING CONDITIONS

Good housing facilities near town centre and shopping area. Cardiff is within easy reach of seaside and famous rural beauty spots.

APPLICATIONS TO:

Secretary, Welsh Regional Hospital Board, Temple of Peace and Health, Cathays Park, Cardiff, should be received by the 11th June. Please state age, qualifications, experience, present position and salary, names and addresses of two referees. Candidates should state also, whether, in the event of their not being accepted in the grade applied for, they wish to be considered for another grade. 4673

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

Fourth Assistant Engineer (Protection)

APPPLICATIONS are invited for appointment as FOURTH ASSISTANT ENGINEER in the Protection Section of the Technical Department, Yorkshire Division, with Headquarters at Rotherham.

Applicants should possess technical qualifications leading to Corporate Membership of the I.E.E. and have experience in the application or maintenance of control and protective equipments applied to high-voltage transmission and generating systems.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Schedule B, Grade 8 (£735-£960 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1, Whitehall Road, Leeds, 1, to whom they should be returned to arrive not later than the 16th June, 1960. 4687

UNIVERSITY OF BIRMINGHAM

invites applications for the following posts in the department of the Superintendent of Buildings :—

(a) ELECTRICAL ENGINEER. Salary scale £950-£1,100 (at present under review). Preference will be given to qualified men who have some experience of the maintenance of large modern installations.

(b) CHIEF CLERK. Salary scale as above. Preference will be given to a qualified man having experience in a similar organisation, i.e., local government, hospital service or contractors' office.

Further particulars from and applications to be addressed to the Superintendent of Buildings and Chief Engineer, The University, Edgbaston, Birmingham, 15, not later than 11th June, 1960. 4707

LONDON ELECTRICITY BOARD

District Senior Commercial Assistant

APPLICATIONS are invited for the above position in the Board's Kent Suburban District. The successful candidate will be based at 9, Pier Road, Erith, Kent, but will be required to work anywhere in the District and may, in emergency, be called upon to undertake duties in the showrooms.

Applicants should be competent to control representatives engaged on matters connected with supply, tariffs, apparatus and sales to consumers with domestic or small commercial or industrial installations. The possession of the E.D.A. Salesmanship Diploma would be considered an advantage.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 4, i.e., £795 p.a. to £870 p.a. plus appropriate London area allowance.

Application form obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2. Please quote ref. PER/V/2924/R. 4690

NORWICH EDUCATION COMMITTEE

The Norwich City College and Art School, Ipswich Road, Norwich, NOR 67 D

Principal :
Frank Briers, B.Sc., D.Phil. (Oxon.), F.R.I.C.

WANTED, LECTURER IN ELECTRICAL ENGINEERING, to commence duties 1st September, 1960, or as soon as possible thereafter. Duties will include teaching in the Higher National Diploma Sandwich Course, in National Certificate Courses and in City and Guilds Courses. Candidates must be well qualified in electrical engineering and should have had several years of industrial and teaching experience.

Salary scale £1,370 rising by increments of £35 to £1,550.

Application forms, which may be obtained from the Director of Education, City Hall, Norwich, NOR 01 A. on receipt of a stamped addressed envelope, should be returned to the Principal as soon as possible. 4718

COUNTY BOROUGH OF BOLTON EDUCATION DEPARTMENT

Bolton Technical College

Electrical Engineering Department

APPLICATIONS are invited for the following post, duties to commence September, or as soon as possible thereafter :—

SENIOR LECTURER with special interests in the power field, who is prepared to offer subjects up to the standard of Part III of the examination of the Institution of Electrical Engineers.

Salary will be in accordance with the Burnham Scale for Teachers in Technical Colleges, viz., £1,550 × £50 to £1,750. Commencing salary will depend on experience and qualifications.

Application forms obtainable by sending a foolscap s.a.e. to the Chief Education Officer, Education Offices, Nelson Square, Bolton, to whom completed application forms should be returned not later than 17th June, 1960. 4688

COUNTY COUNCIL OF THE WEST RIDING OF YORKSHIRE

ASSISTANT ELECTRICAL ENGINEER required for the County Architect's Office at Wakefield. Salary range :—

Special Grade ...	£785-£1,070, or
A.P.T. III ...	£880-£1,065, or
A.P.T. II ...	£765-£880

according to qualifications and experience.

Applicants should be capable draughtsmen with good experience in the preparation of schemes, specifications and estimates for all classes of electrical work.

Applications stating age, qualifications, experience, present position, and giving names and addresses of two referees, to be sent to the undersigned not later than Tuesday, 21st June, 1960.

A. W. GLOVER, F.R.I.B.A.,
County Architect.

Bishopgarth,
Westfield Road,
Wakefield.

4730

Situations Vacant (continued)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Northmet Sub-Area

BARNET DISTRICT

DISTRICT COMMERCIAL ASSISTANT (Ref. 965) (134/60.N).

Candidates should be fully experienced in modern installation practice, able to prepare specifications and competitive quotations, and be competent to design thermal storage heating schemes, particularly floor warming. Sound knowledge of the tariffs and their application, including supply by special agreement, is necessary.

Salary N.J.C. Grade 3 (£720-£780) plus London allowance.

Apply by letter to F. G. Bromley, B.Sc.(Hons.), Eng.M.B.I.M., M.I.E.E., Manager, Eastern Electricity Board, 7c, High Street, Barnet, Herts, by 15th June, 1960.

ENFIELD DISTRICT

FOURTH ASSISTANT ENGINEER (Ref. 972) (137/60.R).

Candidates should have had a sound technical training and suitable experience in the construction and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class G, Grade 11 (£765-£810) plus London allowance.

Apply by letter to A. T. Durbridge, Manager, Eastern Electricity Board, 40, Church Street, Enfield, by 15th June, 1960.

ST. ALBANS DISTRICT

THIRD ASSISTANT ENGINEER (Ref. 975) (135/60.R).

Candidates should have had a sound technical training and suitable experience in the construction and maintenance of H.V. and L.V. distribution systems including substations.

Salary N.J.B. Class G, Grade 9 (£860-£905).

Apply by letter to F. J. Drake, Assoc.I.E.E., Manager, Eastern Electricity Board, 107, St. Peter's Street, St. Albans, by 13th June, 1960.

Suffolk Sub-Area

NORTH EAST SUFFOLK DISTRICT

SECOND ASSISTANT ENGINEER (136/60.R).

Candidates should have had a sound technical training and considerable experience in the construction, operation and maintenance of H.V. and L.V. overhead and underground systems (including substations) at voltages up to and including 33 kV.

Salary N.J.B. Class F, Grade 7 (£910-£955).

The successful candidate will be required to reside within reasonable proximity of Beccles.

Apply by letter to J. H. Shepherd, A.M.I.E.E., Manager, North East Suffolk District, Eastern Electricity Board, The Grove, Ingate, Beccles, Suffolk, by 13th June, 1960.

Fens Sub-Area

THIRD ASSISTANT ENGINEERS (Operations and Maintenance) (126/60.N).

Vacancies exist for two Third Assistant Engineers in the Sub-Area, one based at Cambridge and one at Peterborough. The duties include the organisation of routine inspection and maintenance of all lines, plant and equipment in the two regions of the Sub-Area, and applicants should have had experience in this field. Technical education to Grad. I.E.E. standard would be an advantage.

Salary N.J.B. Class K, Grade 10 (£965-£1,025).

GENERAL ASSISTANT ENGINEER (126/60.N).

A vacancy exists for an engineer of good technical education in the Construction (Preparation) Section of the Sub-Area Engineer's Department. The duties include the survey and preparation of line schedules for 33-kV and 11-kV lines throughout the Sub-Area, and the position offers a good opportunity to gain experience in this field.

Salary N.J.B. Class K, Grade 15 (£710-£755).

For these appointments apply by letter to the Secretarial Officer, Eastern Electricity Board, Fens Sub-Area, Milton Hall, Milton, Cambridge, by 10th June, 1960. 4743

AEI

ASSOCIATED ELECTRICAL INDUSTRIES LIMITED

EDITORIAL ASSISTANT

ASSOCIATED ELECTRICAL INDUSTRIES LTD. have a vacancy at Trafford Park for an Editorial Assistant. This appointment offers an opportunity to work in close contact with engineers and scientists concerned with the foremost electrical engineering projects in the world.

Duties will include the editing and preparation of technical sales literature, instruction books, etc., and demand the ability to write clearly and concisely on an interesting variety of electrical engineering subjects.

Technical background and editorial experience preferred, but consideration will be given to suitable applicants wishing to enter this field.

Write fully, please, to :—

The Publicity Manager
ASSOCIATED ELECTRICAL INDUSTRIES (MANCHESTER) LTD.
Trafford Park, Manchester, 17

4605

YORKSHIRE ELECTRICITY BOARD

Head Office

COMMERCIAL DEPARTMENT

FOURTH ASSISTANT ENGINEER.

Applications are invited for the position of Fourth Assistant Engineer in the Development Section of the Commercial Department at the Board's Head Office.

Applicants must possess at least a Higher National Certificate in Electrical Engineering and have had some practical training and experience, by way of apprenticeship or otherwise.

Duties will include work on the general applications of electricity including particularly off-peak space heating; the interpretation of I.E.E. Wiring Regulations as they apply to general contracting; the collecting and collating of information on technical matters; interpretation and/or drawing up of specifications, safety rules, codes of practice, etc.; general correspondence on all these matters.

Salary N.J.B. Schedule B, Class AX-EX, Grade 8, £735/£25/£860 rising to £960 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Secretary, Yorkshire Electricity Board, Wetherby Road, Scarcroft, Nr. Leeds, not later than 17th June, 1960.

No. 6 (Hull) Sub-Area

GOOLE DISTRICT

SECOND ASSISTANT DISTRICT ENGINEER.

Applicants should have had sound practical experience in the operation, maintenance, planning and construction of H.V. and L.V. underground and overhead lines and substations.

Candidates should have the Higher National Certificate in Electrical Engineering or possess equivalent qualifications.

The successful candidate will be required to undertake standby duty and to reside in Goole or near vicinity.

Salary N.J.B. Class F, Grade 7, £910 × £15 to £955 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, not later than 17th June, 1960.

No. 7 (Grimsby) Sub-Area

GRIMSBY (Louth) DISTRICT

THIRD ASSISTANT DISTRICT ENGINEER.

Applicants should be of Higher National Certificate standard in electrical engineering and have experience in the design, construction, operation and maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant and ancillary equipment.

Salary N.J.B. Class H, Grade 9, £910/£15/£955 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Road, Grimsby, not later than 17th June, 1960. 4748

CENTRAL ELECTRICITY GENERATING BOARD

Southern Division

ASSISTANT ENGINEER (Instruments), EARLEY GENERATING STATION, READING (SEC/3.81/R).

Applicants should have previous experience of modern generating station plant, a good knowledge of the instruments and other measuring apparatus used and have had a sound technical training. Preference will be given to those possessing qualifications leading to Corporate Membership of an appropriate professional institution or equivalent qualifications.

Salary N.J.B. G.10, £815-£860.

GRADE 10 ENGINEER, EARLEY GENERATING STATION, READING (SEC/3.80/R).

Applicants should have had operating experience in a modern generating station. Manufacturing works experience would be an advantage.

Salary N.J.B. G.10, £815-£860.

Special application forms obtainable only from Divisional Secretary, 111, High Street, Portsmouth, should be returned by 14th June, 1960. Please quote reference number. 4741

PEEL PARK TECHNICAL COLLEGE, SALFORD

Principal: F. Wood, M.A. (Oxon), LL.B., A.I.B.

APPLICATIONS are invited for the following post, duties to commence 1st September, 1960 :—

ASSISTANT LECTURER GRADE B IN ELECTRICAL ENGINEERING.

Salary in accordance with the Burnham Technical Scale for Assistant Lecturers Grade B: Men, £700 to £1,150; Women, £630 to £920 plus equal pay differential.

Additions to the above scale are payable for recognised training and degrees.

Forms of application and further particulars may be obtained from the Principal, Peel Park Technical College, Salford, 5, to whom completed forms should be returned within 14 days of the appearance of this advertisement.

R. RIBBLESDALE THORNTON,
Clerk to the Governors.

4719

ENGLISH ELECTRIC VALVE COMPANY LIMITED

TECHNICAL ASSISTANTS

Two Technical Assistants required for the Plant Engineering Division.

TECHNICAL ASSISTANT (Safety). Age 30 to 40.
To be responsible to Plant Engineer for all factory safety, including fire precautions, first aid, and administration of General Register.

TECHNICAL ASSISTANT (Planning). Age 25 to 35.
To be responsible to Plant Engineer for technical records and work planning, including maintenance scheduling and estimating.

Successful applicant will work mainly on his own initiative and plan the work of some 75 men engaged on a variety of tasks.

For both positions a sound knowledge of electricity and a wide engineering background are essential. Technical qualifications should be to O.N.C. standard.

Details of experience, age, present salary, etc., should be sent to :—

Group Personnel Services, Marconi House, 336/7, Strand, London, W.C.2
quoting Reference No. ER.1590A

4717

NORTH WESTERN ELECTRICITY BOARD

Senior Draughtsman (Electrical)
Design Section
Sub-Area Engineering Department
Manchester

Applicants should have had good technical training and drawing office experience in the electrical design, layout and detailing of indoor and outdoor substations up to and including 33,000 volts. Experience in the preparation of protective system schematic and wiring diagrams would be an advantage.

Salary scale £790 × £20 to £890 p.a. Schedule D, Grade 5. N.J.B. conditions.

Applications must be made on a form to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 13th June, 1960.

Senior Assistant Engineer (Domestic Sales)
Sub-Area Commercial Department, Oldham

Duties will include the supervision of all aspects of domestic load development, including publicity, management of service centres and the sale, installation and maintenance of appliances.

Preference will be given to applicants who are Corporate Members of the Institution of Electrical Engineers.

Salary scale £1,600-£1,705 p.a. Grade L.4. N.J.B. conditions.

Second Assistant Engineer (Power Sales)
Sub-Area Commercial Department, Oldham

Applicants preferably should have experience in the application of electricity to cotton spinning, textile machinery manufacture, general engineering and chemical industries, and be familiar with electricity tariffs.

Corporate Membership of the Institution of Electrical Engineers would be an advantage.

Salary scale £1,270 × £30 to £1,360 p.a. Grade L.7. N.J.B. conditions.

Third Assistant Engineer (Civil Engineering)
Sub-Area Engineering Department, Oldham

Applicants should be suitably qualified and have had experience in preparing sketch schemes, working drawings and specifications for commercial buildings, including service centres and supervision of work on site.

Salary scale £1,025/£1,085 p.a. Grade L.10. N.J.B. conditions.

Applications must be made on a form to be obtained from the Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, and returned to him so as to be received not later than 18th June, 1960. 4751

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule B. Salary includes London allowance.

FOURTH ASSISTANT ENGINEER.
ELECTRICAL DEPARTMENT,
DEVELOPMENT SECTION,
DIVISIONAL HEADQUARTERS,
GENERATION HOUSE
(Vacancy No. 60/378).

Candidates should possess technical qualifications equivalent to Corporate Membership of the Institution of Electrical Engineers and should be conversant with methods of solving short circuit and power flow problems on high-voltage transmission systems. Experience in the use of D.C. and A.C. analysers would be an advantage.

Salary Class AX/EX, Grade 7, £890-£1,115 per annum.

Applications, quoting vacancy number, to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 13th June, 1960. 4715

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Mechanical),
HIGH MARNHAM POWER STATION
(Vacancy No. 133/60).

Applicants are invited for the position of Assistant Maintenance Engineer (Mechanical) at High Marnham Power Station, Near Newark, Notts.

Applicants should possess qualifications in Mechanical Engineering and have had some experience with the maintenance of modern power station plant.

The salary will be in accordance with Class M, Grade 8 (£1,270-£1,360 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

GENERAL ASSISTANT ENGINEERS,
CASTLE DONINGTON POWER
STATION (Vacancy No. 134/60).

Applications are invited for the positions of General Assistant Engineers at Castle Donington Power Station, Near Derby.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range (£560-£700 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

FOURTH ASSISTANT ENGINEER,
COVENTRY SECTION
(Vacancy No. 135/60).

Applications are invited for the position of Fourth Assistant Engineer at Coventry Transmission Section, Victoria Mills, Bulkington, Near Nuneaton.

Applicants should have experience of maintenance and operation of E.H.T. overhead lines, transformers and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

The salary will be in accordance with Class AX/EX, Grade 8 (£735-£960 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent or Section Engineer concerned, and should be returned to the Station or Section Office by the date stated.

O. S. WOODS,
Divisional Controller.

26th May, 1960. 4737

PERMACEL TAPES LIMITED

require a

SALES ENGINEER

for Pressure Sensitive Electrical Tapes
and Associated Products

Applicants should have a sound basic knowledge of electrical engineering and experience in selling to this industry. The area is Northern England and Scotland, and residence in the Manchester, Liverpool or West Riding area is necessary.

Excellent scope and prospects to a man with real sales ability, drive and energy.
A generous salary and expense allowance is offered.
Car provided.
Pension scheme and other benefits.

Applicants should write giving full details of age, experience and qualifications to:—

THE HOME SALES MANAGER
PERMACEL TAPES LIMITED
260, BATH ROAD, SLOUGH, BUCKS
A Johnson & Johnson Company

4712

***Situations Vacant** (continued)*

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following positions within the Division :—

DEPUTY STATION SUPERINTENDENT,
NORTH WILFORD
POWER STATION
(Vacancy No. 121/60).

Applicants should be Corporate Members of the Institution of Mechanical and/or Institution of Electrical Engineers, and have experience in a responsible position with the operation and maintenance of modern large capacity high-pressure plant employing pulverised fuel boilers.

The successful applicant should also possess sound administrative and organising ability.

The salary will be in accordance with Class K, Grade 2 (£1,725-£1,830 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications, 10th June, 1960.

SENIOR DRAUGHTSMAN
(Civil Engineering and Building),
TRANSMISSION DEPT.,
DIVISIONAL HEADQUARTERS
(Vacancy No. 124/60).

Applicants for this appointment should have suitable technical training and be thoroughly conversant with the design and detailing for civil and building works, including steel and R.C. structures and foundations. The work is associated with H.V. substations and generating stations.

Salary will be in accordance with Grade 4 of Schedule D of the National Joint Board Agreement and will be within the range £930-£1,030 per annum.

Closing date for receipt of applications, 10th June, 1960.

GENERAL ASSISTANT
ENGINEERS (Chemists),
WILLINGTON, CASTLE
DONINGTON, SPONDON AND
LEICESTER POWER STATIONS
(Vacancy No. 127/60).

Candidates must have had a sound technical training and previous laboratory experience and should preferably hold the Higher National Certificate in Chemistry, but consideration will be given to candidates studying for that qualification.

The salary will be in accordance with Schedule A of the National Joint Board Agreement and will be within the range £560-£700 per annum.

Candidates should state on their application if they have preference for any of the stations.

Closing date for receipt of applications, 10th June, 1960.

ASSISTANT SHIFT CHARGE
ENGINEER, DRAKELOW "B"
POWER STATION
(Vacancy No. 130/60).

Applicants should have received a sound technical training and have had experience in a modern power station. Preference will be given to candidates who possess the Higher National Certificate or its equivalent.

Salary will be in accordance with Class L, Grade 8 (£1,195 - £1,270 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 10th June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.

4739

ESTIMATOR

ESTIMATOR required to prepare tenders for special types of motors and generators. Willing to train engineer with reasonable electrical knowledge. Near S.E. London. Attractive salary, superannuation.

Apply Works Director, E.D.C.C., St. Mary Cray, Kent.

4679

PRESTCOLD DIVISION

Pressed Steel Company Limited

wish to appoint a

CONVEYOR CONTROL ENGINEER

who will be responsible for ensuring the continuous operation of an extensive conveyor system in the Division's new Swansea Factory and for the testing and maintenance of the conveyor gear and associated equipment.

The conveyor system is one of the largest and most up-to-date of its kind, and the position is therefore a responsible one, carrying a substantial salary.

This is a monthly staff appointment. Conditions of service accord with the best industrial practice and include a contributory pension scheme with free life assurance benefits. Assistance with housing can be given in certain cases.

Candidates should have had practical training and experience in electrical work and a National Certificate is a desirable qualification.

Applications, quoting Ref. ER/0184, should be sent to :—

Personnel Officer, Prestcold Division

PRESSED STEEL COMPANY LIMITED

Crymlyn Burrows, Swansea

4726

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

APPLICATIONS are invited for the following positions within the Division:—

GENERAL ASSISTANT ENGINEERS,
TECHNICAL DEPARTMENT
(Vacancy No. 138/60).

Duties will include assisting with laboratory and field tests in connection with all sections of the Technical Department.

Preference will be given to applicants who hold, or are studying for, the Higher National Certificate (Electrical Engineering).

The successful candidates will be expected to reside in or near Loughborough, Leicestershire.

The salary will be in accordance with Class AX/EX, Grade 9 (£570-£725 per annum) of Schedule B of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

FOURTH ASSISTANT ENGINEER,
TECHNICAL DEPARTMENT,
SOUTHERN DISTRICT OFFICE,
LEICESTER POWER STATION
(Vacancy No. 139/60).

The minimum technical qualification desired is the Higher National Certificate in Electrical Engineering and preference will be given to candidates who have completed a recognised post-graduate apprenticeship.

Experience of high voltage switchgear and protective gear will be an advantage.

The successful candidate will be expected to reside in or near Leicester.

The salary will be in accordance with Class AX/EX, Grade 7 (£840-£1,065 per annum) of Schedule B of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

FOURTH ASSISTANT ENGINEER,
TECHNICAL DEPARTMENT,
DIVISIONAL HEADQUARTERS
(Vacancy No. 140/60).

The minimum technical qualification desired is the Higher National Certificate in Electrical Engineering and preference will be given to candidates who have completed a recognised post-graduate apprenticeship.

Experience of high voltage switchgear and protective gear will be an advantage.

The salary will be in accordance with Class AX/EX, Grade 8 (£735-£960 per annum) of Schedule B of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.

27th May, 1960. 4738

EAST MIDLANDS ELECTRICITY BOARD

Leicester Sub-Area

APPLICATIONS are invited from suitably qualified and experienced persons for the following appointments. Applicants should state age, qualifications, present position and salary, previous experience, and quote the appropriate vacancy number.

THIRD ASSISTANT DISTRICT
ENGINEER, Leicester Sub-Area
(Vacancy No. 67/60).

Salary N.J.B. Class F, Grade 9, £815 × £15 to £860 per annum.

Candidates should have practical experience in the construction, operation and maintenance of underground distribution systems up to and including 11 kV. Ability to drive a car is essential, and the successful candidate will be required to reside in Leicester and to undertake standby duties.

THIRD ASSISTANT DISTRICT
ENGINEER, Loughborough District
(Kibworth Section)
(Vacancy No. 68/60).

Salary N.J.B. Class F, Grade 9, £815 × £15 to £860 per annum.

Candidates should have practical experience in the construction, operation and maintenance of 11-kV and L.V. underground and overhead distribution systems. Ability to drive a car is essential, and the successful candidate will be required to reside in or near Kibworth and to undertake standby duties.

Applications for the above vacancies should be addressed to the Manager, Leicester Sub-Area, Charles Street, Leicester, to reach him within fourteen days of the date of this advertisement.

4749

LIGHTING ENGINEER/DRAUGHTSMAN

required by leading lighting fittings manufacturer. Capable of preparing interior lighting designs, estimates, surveys, etc. Age 22/28. Salary depending on age and experience.

Write—Box 4720.

THE GENERAL ELECTRIC COMPANY LIMITED

OPERATIONS ENGINEERS

SENIOR staff experienced in modern power plant are required for turbine operation and maintenance services at home and abroad.

We are looking for qualified engineers with an analytical approach who are capable of independent decisions on problems concerned with the running of power plant of any capacity.

These positions offer opportunity for men who wish to progress by their own efforts.

Please apply in writing, giving full details, to Personnel Manager (JVG), The General Electric Company Limited, Erith, Kent.

4595

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER, Sutton District. Salary £860 × £15 to £905 p.a. under N.J.B. Class G, Grade 9, plus London allowance. Superannuable. Applicants should have had a good general education, be technically trained up to Higher National Certificate standard, and must have had practical experience in general distribution work on H.V. and L.V. systems. Ability to plan and prepare schemes for mains extensions would be an advantage.

Applications, quoting ER, and naming 2 referees, on forms from District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 15th June, 1960.

ASSISTANT DISTRICT ENGINEER, Sutton District. Salary £765 × £15 to £810 p.a. plus London allowance under N.J.B. Class G, Grade 11. Superannuable. Applicants should possess the Higher National Certificate in Electrical Engineering and have had a thorough training in underground and overhead distribution systems.

Applications, quoting ER, and naming 2 referees, on forms from District Manager, SEEBOARD, 52, High Street, Sutton, Surrey, by 15th June, 1960.

ASSISTANT DISTRICT ENGINEER, Woking District. £815 × £15 to £860 per annum, N.J.B. Class F, Grade 9. Superannuable. Applicants, of good general education, should have had technical training to H.N. standard with practical experience of general distribution work, and be capable of giving assistance on planning, construction or maintenance work.

Applications, quoting ER, and naming 2 referees, on forms from District Manager, SEEBOARD, 4, Chobham Road, Woking, by 15th June, 1960.

GEORGE WRAY,
Secretary. 4747

SOUTH WALES ELECTRICITY BOARD

Assistant Engineer

APPLICATIONS are invited for the position of ASSISTANT ENGINEER in the Port Talbot District in the Swansea and West Central Area of the Board.

The salary for the position will be in accordance with Class H, Grade 11 (£815/£860) of the National Joint Board Agreement for the Electricity Supply Industry.

Applications stating age, present position, present salary, qualifications and experience should be addressed to G. R. T. Edwards, B.Sc., M.I.E.E., M.Am.I.E.E., Manager, Swansea and West Central Area, 29, Ystrad Road, Swansea Industrial Estate, Swansea, Glam., so as to reach him not later than Thursday, 16th June, 1960.

Envelopes should be endorsed "Assistant Engineer, 114/60."

R. G. WILLIAMS,
Secretary. 4728

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—

Area Board Headquarters

Chief Engineer's Department, Carliol House

SENIOR DRAUGHTSMAN, Section Leader. Applicants must be experienced draughtsmen and fully conversant with modern drawing office methods.

Salary Schedule D, Grade 3, £1,055/£1,155. N.J.B. conditions of service.

FOURTH ASSISTANT ENGINEERS, Technical Section, for general technical duties. Applicants must possess H.N.C. in electrical engineering, or equivalent, and experience with H.V. protection equipment, instruments, electronics or meters an advantage.

Salary Schedule B, Grade 8, £735/£935. N.J.B. conditions of service.

Wear Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER, Crook District. Applicants must have had sound training and be experienced in construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground distribution networks, substation plant and auxiliary equipment. Preference will be given to candidates with qualifications leading to Corporate Membership of I.E.E.

Salary Schedule A, Class E, Grade 7, £860/£905. N.J.B. conditions of service.

Tees Sub-Area

THIRD ASSISTANT DISTRICT ENGINEERS with location at Darlington (two), Hartlepools (one) and Stockton (one) respectively.

Salaries Schedule A, Class F, Grade 9, £815/£860. N.J.B. conditions of service.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, within ten days of the appearance of this advertisement. 4750

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. appointments.

ASSISTANT SHIFT CHARGE ENGINEER, USKMOUTH "A" POWER STATION, NEWPORT, MON.
(Vacancy No. 143/ER/60).

Salary K.8, £1,095-£1,170 per annum, plus 10% shift enhancement.

Experience in a modern power station essential. Appropriate engineering qualifications and a regular apprenticeship desirable.

ASSISTANT SHIFT CHARGE ENGINEER, ROGERSTONE POWER STATION, MON. (Vacancy No. 144/ER/60).

Salary G.8, £910-£955 per annum, plus 10% shift enhancement.

Applicants should possess appropriate engineering qualifications and have had experience in a modern power station.

MAINTENANCE ENGINEER (Planning), TIR JOHN POWER STATION, SWANSEA (Vacancy No. 145/ER/60).
(Revised Advertisement).

Salary H.7, £1,025-£1,085 per annum.

Applicants should possess H.N.C. or equivalent qualifications and have had experience in a modern power station. The successful applicant will be responsible to the Deputy Station Superintendent for the planning of all overhaul and preventive maintenance. The appointment offers ample scope for initiative and experience to the right person.

Previous applicants need not re-apply.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Road, Gabalfa, Cardiff, to be returned by 17th June, 1960. 4742

MIDLANDS ELECTRICITY BOARD

North Staffs Sub-Area

APPLICATIONS are invited for the following superannuable posts :—

SENIOR ASSISTANT ENGINEER (Construction) (Headquarters).

Applicants must have a comprehensive knowledge of the engineering problems associated with the distribution of electricity, and the duties will include responsibility for the construction and maintenance of substations, underground mains and overhead lines up to 33 kV. Technical qualifications desirable. Salary £1,600/£1,705 per annum. (N.J.B. Grade L.4).

THIRD ASSISTANT DISTRICT ENGINEER (Stoke South District).

Duties include the construction, operation and maintenance of H.V. and L.V. mains and substations, and applicants should have had experience in the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary £860/£905 per annum (N.J.B. Grade G.9).

Apply by letter, within 14 days, stating age, experience, present position and salary to Mr. C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234, Victoria Road, Fenton, Stoke-on-Trent.

F. W. CATER,
Secretary. 4729

THE HEPWORTH IRON COMPANY LIMITED

DEVELOPMENT ENGINEER

MINIMUM qualification H.N.C. in Electrical Engineering and preferably well experienced in distribution and orthodox cable jointing practices. The successful candidate will be based at Kingston-upon-Thames and will be given considerable scope and every opportunity to develop new techniques, including the jointing of both paper and plastic-insulated cables.

Applications will be treated in the strictest confidence and should be sent under confidential cover, endorsed "Development Engineer," to the Sales Manager, The Hepworth Iron Company Ltd., 116, Canbury Park Road, Kingston-upon-Thames.

4725

Situations Vacant (*continued*)

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

PLANT CONTROL ENGINEER,
CASTLE DONINGTON
POWER STATION
(Vacancy No. 141/60).

Applications are invited for the position of Plant Control Engineer at Castle Donington Power Station, near Derby.

Candidates should have had operating experience on large modern pulverised fuel-fired boilers and associated turbines.

The possession of the Ordinary National Certificate, or the pursuit of studies leading thereto, will be an advantage.

Salary will be in accordance with Class L, Grade 10 (£1,025-£1,085 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications, 17th June, 1960.

GENERAL ASSISTANT ENGINEER,
LEICESTER POWER STATION
(Vacancy No. 142/60).

Applications are invited for the position of General Assistant Engineer at Leicester Power Station, Rawdykes Road, Leicester.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge, and will be within the range £560-£700 per annum of the National Joint Board Agreement.

Closing date for receipt of applications, 17th June, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to the Station by the date stated.

O. S. WOODS,
Divisional Controller.

27th May, 1960. 4736

COST ESTIMATORS

required at

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

MECHANICAL / ELECTRICAL COST ESTIMATORS (Ref. 1698/48), to assist in preparation of detailed estimates of cost of mechanical and/or electrical engineering components for large capital projects; liaison with scientists, engineers and finance officers will be necessary.

ELECTRICAL COST ESTIMATOR (Ref. 1641/48), to estimate and place orders for manufacture and installation of experimental electrical and electronic equipment. Knowledge of basic stores and contract procedure an advantage. Work involves technical liaison with firms, preparation of cost estimates and maintenance of work in hand records.

SALARY: £925 (at age 30 or over) to £1,105 per annum.

QUALIFICATIONS: Apprenticeship or equivalent training. Appropriate National Certificate an advantage.

For ref. 1698/48: Good engineering background, and adaptability. Experience in estimating desirable.

For ref. 1641/48: Knowledge of the manufacturing problems of electrical and electronic prototype and experimental equipment.

Housing and superannuation schemes.

Send POSTCARD for details to Personnel Manager (quoting appropriate reference number), U.K.A.E.A., A.E.R.E., Harwell, Didcot, Berks. 4746

HENDREY RELAYS LIMITED

392, Bath Road, Slough, Bucks

SALES ENGINEER with experience in the preparation of estimates and tenders for light electro-mechanical instruments and devices required immediately.

Good conditions. 5-day week. Contributory pension scheme.

Apply in writing giving age, details of training and experience and salary required to the General Manager. 4691

British Railways (Southern Region)

require an

ELECTRICAL ENGINEERING TECHNICAL ASSISTANT

in the MANCHESTER AREA for the inspection and testing of electric and diesel electric rolling stock and power supply equipment at contractors' works. Applicants should have had a sound technical training and have reached a standard of not less than that of the Higher National Certificate in Electrical Engineering. Manufacturing experience essential.

Commencing salary £990 per annum rising to £1,034 after two years.

Application forms may be obtained from the Chief Mechanical and Electrical Engineer, British Railways, Southern Region, 15, St. Thomas Street, London Bridge, London, S.E.1. 4675

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

GENERAL ASSISTANT ENGINEER required at Portishead "B" Power Station. Superannuation scheme. Salary N.J.B. Class K, Grade 15, £710-£755 per annum.

Preference will be given to candidates who hold or are at present studying for a Higher National Certificate or similar qualification.

Closing date, 14th June, 1960. Please quote Ref. ER/AV/64/60.

ASSISTANT SHIFT CHARGE ENGINEER required at East Yelland Power Station, North Devon. Superannuation scheme. Salary N.J.B. Class H, Grade 9, £910-£955 per annum plus 10% for shift duties.

Applicants should possess good technical qualifications and should have had training and experience in the control and operation of modern steam generating plant and main switchgear.

Closing date, 14th June, 1960. Please quote Ref. ER/AV/65/60.

ASSISTANT SHIFT CHARGE ENGINEER required at Newton Abbot Power Station. Superannuation scheme. Salary N.J.B. Class F, Grade 9, £815-£860 per annum, plus £90 p.a. for shift duties.

Applicants should possess good technical qualifications and should have had training and experience in the control and operation of modern steam generating plant and main switchgear.

Closing date, 13th June, 1960. Please quote Ref. ER/AV/72/60.

Applications on form A.E.6/ACT, obtainable from the Divisional Secretary, 26, Oakfield Road, Bristol, 8, should be completed and returned by the date stated. 4734

COUNTY BOROUGH OF GRIMSBY

Borough Engineer and Surveyor's Department

Appointment of Public Lighting Superintendent

THE Highways and Public Works Committee invite applications for the appointment of a PUBLIC LIGHTING SUPERINTENDENT, the salary scale for which will be in accordance with Grade A.P.T. II of the Scheme of Conditions of Service for Local Authorities' Administrative, Professional, Technical and Clerical Services, that is, £765-£880 per annum. The commencing point on the scale to be in accordance with qualifications and experience.

Street lighting is by electricity only, and preference will be given to candidates who are Members of the Public Lighting Engineers' Association and/or the Illuminating Engineering Society.

The appointment will be subject to the provisions of the Local Government Superannuation Acts and to one month's notice on either side, whilst the successful candidate will be required to pass a medical examination.

Form of application and particulars of duties can be obtained from the undersigned, to whom the completed application should be forwarded, accompanied by copies of two recent testimonials, so as to reach this office not later than 10 a.m. on Saturday, 18th June, 1960.

J. V. OLDFIELD, M.Inst. C.E.,
Borough Engineer & Surveyor.

Municipal Offices,
Town Hall Square,
Grimsby.

4708

MIDDLESEX COUNTY COUNCIL EDUCATION COMMITTEE

Hendon Technical College, The Burroughs Hendon, London, N.W.4

APPLICATIONS are invited for the following posts. Successful applicants will be expected to take up their duties as early as possible during the next academic year which commences in September, 1960.

Electrical Engineering Department

TWO SENIOR LECTURERS to teach one or more of the following subjects to the standard of the Part III Examination of the Institution of Electrical Engineers:—

Advanced Electrical Engineering.
Electrical Measurements.
Electrical Supply.

Candidates must be Graduate and Corporate Members of the Institution of Electrical Engineers with appropriate industrial and teaching experience.

TWO ASSISTANTS GRADE B to teach two or more Electrical Engineering subjects up to Higher National Certificate level.

Candidates should be graduates or hold an equivalent qualification and have industrial experience.

Salary within the range (men):—

Senior Lecturer, £1,588-£1,801 per annum.
Assistant Grade B, £828-£1,486 per annum.

Application forms (s.a.e.) and further details of all posts may be obtained from the Clerk to the Governing Body, Town Hall, The Burroughs, Hendon, London, N.W.4, to whom completed applications should be returned within 14 days of the appearance of this advertisement.

C. E. GURR, M.Sc., Ph.D.,
Secretary to the Education Committee.

4752

AIR MINISTRY

ASSISTANT MECHANICAL and ELECTRICAL ENGINEERS required for design, construction and maintenance of installations on airfields, radar stations, missile bases, workshops and maintenance units for R.A.F. at home and overseas as well as certain Civil Airports.

Salary £805 at 25 to £1,095 at 34 or over, thereafter rising to maximum £1,260, with increase for London and slight decrease for country districts. Appointments non-pensionable but long term. Promotion prospects. 5-day week with 4 weeks 2 days leave a year initially. Special allowance in addition to salary during overseas service.

Qualifications and experience:—

- (i) (a) University Degree or equivalent diploma in electrical and/or mechanical engineering with at least 2 years' apprenticeship; or
  - (b) Graduate or Corporate Member of I.E.E. with at least 3 years' apprenticeship; or
  - (c) Graduate or Corporate Member of I.Mech.E., appreciable electrical engineering experience with at least 3 years' apprenticeship; and
- (ii) Have been employed for minimum of 2 years with well-established engineering concern and gained wide experience in both electrical and mechanical engineering practice.

Applicants must be natural-born British subjects between ages of 25 and 45.

Forms from Ministry of Labour, Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.158/OA. 257

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for the undernoted superannuable positions :—

(1) SHIFT CHARGE ENGINEER,
CLYDE'S MILL
GENERATING STATION
(Ref. G16/60).

Applicants should have had considerable experience in the operation of modern turbine and boiler plant and, preferably, possess a Higher National Certificate in Electrical or Mechanical Engineering.

Salary N.J.B. Class K, Grade 7, £1,195/£1,270 (plus shift allowance of 10% per annum).

(2) PLANT SHIFT CONTROL
ENGINEERS, KINCARDINE
GENERATING STATION
(Ref. G17/60).

Applicants should have experience of station control room duties in a modern power station and possess qualifications of Higher National Certificate standard or equivalent. The duties will include operation and supervision of all control equipment associated with main plant.

Salary N.J.B. Class K, Grade 10, £965/£1,025, rising ultimately to Class M, Grade 10, £1,095/£1,170 (plus shift allowance of 10% per annum).

Housing accommodation may be made available if required.

Applications, on the standard form and quoting appropriate reference number, should be submitted to the Secretary, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4, not later than 17th June, 1960.

4709

CENTRAL ELECTRICITY GENERATING BOARD

London Division

APPLICATIONS invited for following superannuable post. Conditions of service in accordance with N.J.B. Agreement, Schedule B. Salary includes London allowance.

THIRD ASSISTANT ENGINEER,
OPERATIONAL RESEARCH DEPT.,
DIVISIONAL HEADQUARTERS,
GENERATION HOUSE
(Vacancy No. 60/377).

Ambitious young engineers who would like experience in assisting in the solution of management problems and a chance to view the workings of the industry in broad perspective, prior to moving to higher posts.

Essential qualifications are that candidates should have :—

(a) A minimum academic qualification of H.N.C.
(b) A flair for investigation.
(c) Flexible, questioning minds.
(d) An ability to approach people at all levels with tact and patience.

Some knowledge of statistics and method study would be useful but are not essential since training will be given.

Salary Class AX/EX, Grade 6 = £975-£1,220 per annum.

Applications, quoting vacancy number, to (or on form from) Personnel Officer, Central Electricity Generating Board, London Division, P.O. Box 136, London, W.1, by 13th June, 1960.

4716

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

GENERAL ASSISTANT ENGINEERS are required at Ocker Hill Power Station for generation operational duties. N.J.B. service conditions, superannuable appointment, salary within Schedule A, G.14, £610-£655, rising to £700 per annum.

Applicants should have received a sound technical training and preferably have had some industrial engineering experience, and have as a minimum qualification the Ordinary National Certificate.

Apply, quoting Vacancy No. 127/60MD, on forms AE6, which are available from the Station Superintendent, Ocker Hill Power Station, Bayleys Lane, Ocker Hill, Tipton, Staffs, to whom they should be returned when completed not later than 17th June, 1960.

4714

Circuit Design Draughtsmen

MEN who have had experience in the design or manufacture of high-voltage switchgear and who have qualifications to at least O.N.C. standard are invited to apply for the above vacancies.

Salaries paid will be above A.E.S.D. rates and for men with the right experience will be in the region of £1,100 p.a.

Write stating age and experience to

MACGREGOR BEAN & CO. LTD.
2a, Cambridge Grove Road
Kingston-on-Thames, Surrey

4695

CENTRAL ELECTRICITY GENERATING BOARD

Eastern Division

APPLICATIONS are invited for the following appointment :—

GENERAL ASSISTANT ENGINEER,
PETERBOROUGH
GENERATING STATION.

Salary Class F, within the range of Grades 14/12, £560 × £15 to £700 per annum, plus £90 per annum shift allowance whilst engaged on shift duties.

The commencing salary will depend upon the duties and responsibilities.

Duties include assisting in the electrical control room and experience in the technical operation of electrical, boiler house and turbine house plant, testing, etc., in a generating station and provide a suitable basis for promotion to higher technical grades.

Manual workers in skilled grades with suitable technical training will be considered. Previous experience in a generating station and/or technical training to the standard of Ordinary National Certificate or its equivalent will be of advantage.

Applications, quoting Reference No. S.V. 1345, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Place, Chalk Lane, Cockfosters, Barnet, Herts., by the 11th June, 1960.

4686

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Sub-Area

Third Assistant Commercial Engineer

APPLICATIONS are invited for the appointment of THIRD ASSISTANT COMMERCIAL ENGINEER in charge of the Board's Central Repair Workshop at Leven Street, Motherwell.

Applicants should have served an apprenticeship with subsequent practical experience in the repair and maintenance of all types of domestic electrical appliances and have experience in the control of staff. Possession of a National Certificate in Electrical Engineering or equivalent qualification would be advantageous.

The appointment is superannuable and the conditions of employment will be in accordance with the National Joint Board Agreement, Schedule A and the salary in accordance with Class L, Grade 10, £1,025/£1,085 per annum.

The successful candidate will require to reside within a reasonable distance of the Board's premises at Motherwell.

Application forms which may be obtained from the undersigned should be forwarded to this office within 14 days of the date of this advertisement.

R. J. RENNIE,
Manager.

Montrose Crescent,
Hamilton.

4769

ELECTRICAL SUBSTATION OPERATOR

required at

ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL

APPLICATIONS are invited for this responsible post involving operations on the Establishment's ELECTRICAL DISTRIBUTION SYSTEM.

Duties include operation, isolation and earthing-down on 11-kV and MV systems, relay and oil testing, keeping records and issuing MV access permits.

SALARY £740 (at age 26) to £925 p.a.

Applicants should have served a recognised engineering apprenticeship or have had equivalent training and have practical experience with substation type equipment.

O.N.C. in electrical engineering subjects or equivalent an advantage.

Temporary shift duties may be required occasionally to cover abnormal system conditions.

Housing and contributory pension schemes.

Send POSTCARD for application form to Senior Recruitment Officer (1689/48), U.K.A.E.A., A.E.R.E., Harwell, Didcot, Berks.

4674

LONDON ELECTRICITY BOARD

Engineer (Operation and Maintenance) Transmission

APPLICATIONS are invited for the above position in the Operations Branch of the Chief Engineer's Department. The successful applicant will be based at Chelsea, but may be required to undertake duties anywhere within the Board's area.

Applicants should have had a sound technical education and possess the Higher National Certificate. They should be experienced in load flow and short circuit calculations.

The post is graded under Schedule B of the National Joint Board Agreement as Grade 8, and the commencing salary within Class AX/EX will be in the range £775 per annum to £1,010 per annum, inclusive of London allowance.

Application form obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref. PER/V/2877/R.

4744

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ENGINEERING DRAUGHTSMAN required in the Electrical Engineer's Drawing Office at Divisional Headquarters, Birmingham.

Applicants should have suitable technical training and be capable, under supervision, of preparing detail drawings in connection with the construction of high-voltage substations.

Salary will be in accordance with Grade 6 of Schedule D of the National Joint Board Agreement, within the range £620 to £740 per annum.

Applications, quoting Vacancy No. 125/60MD, should be submitted on the official form AE6, which may be obtained from the Establishments Officer, Central Electricity Generating Board, Midlands Division, 53, Wake Green Road, Moseley, Birmingham, 13.

Closing date for receipt of applications, 13th June, 1960.

4713

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

SHIFT CHARGE ENGINEER is required at Nechells "A" and "B" Power Station, Birmingham. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K.7, £1,195-£1,270 per annum, plus 10% shift allowance.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear in a large modern power station are required. Appropriate qualifications an advantage.

Apply. quoting Vacancy No. 130/60MD, on form AE6, which are available from Station Superintendent, Nechells Power Station, off Aston Church Road, Nechells, Birmingham, 7, to whom they should be returned when completed not later than 13th June, 1960.

4735

Situations Vacant (continued)

LONDON ELECTRICITY BOARD

Engineer (Construction)

APPLICATIONS are invited for the above position in the Construction Branch of the Chief Engineer's Department at Lesco House, Stamford Street, London, S.E.1.

The successful candidate will be required to assist in supervising the installation of electrical plant, including transformers, switchgear and cables at working pressures up to 66 kV, together with all auxiliary equipment.

Previous experience in this work would be an advantage. Applicants should possess the Higher National Certificate in Electrical Engineering.

The post is graded under Schedule B of the National Joint Board Agreement as Grade 8 and the commencing salary within Class AX/EX will be in the range £775 per annum to £1,010 per annum inclusive of London allowance.

Application form, obtainable from the Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 14 days of the publication date of this notice. Please quote ref. PER/V/2975/R. 4745

ADMIRALTY

TRAINEE ELECTRICAL and MECHANICAL ENGINEERING DRAUGHTSMEN required for unestablished appointments in Bath. Candidates must be British subjects aged 21 and upwards and have been apprenticed or had equivalent workshop experience in either electrical or mechanical engineering in factories or shipyards. Free training in drawing and electrical and mechanical engineering technology for four months beginning October, 1960, at Bath Technical College.

Salary during training £550 (age 21) to £730 according to age and experience, increased (except at age 21) on satisfactory completion of training. Five-day week. 18 days' annual leave. Substantial grants towards travelling expenses for all candidates called for interview.

Apply giving details of age, technical qualifications, apprenticeship (or equivalent) and experience to Director General Ships, Admiralty Offices, Foxhill, Bath. 4677

SURREY COUNTY COUNCIL

APPLICATIONS invited for the following appointments:—

ASSISTANT ELECTRICAL ENGINEERS in salary range £785-£1,220 p.a., plus £45 p.a. London allowance. Commencing salary will be in accordance with qualifications and experience.

ELECTRICAL ENGINEERING ASSISTANT GRADE II (£765-£880 p.a., plus up to £40 p.a. London allowance, according to age). Must hold H.N.C. or have passed Sect. A of I.E.E. and be experienced in layout and design of electrical installation in buildings. Candidates will be appointed at the appropriate point within the scale according to age and ability.

Full details, present salary and three copy testimonials to County Architect, County Hall, Kingston-on-Thames, as soon as possible. 4641

APPLICATIONS are invited for posts of:—

ASSISTANT WORKS ENGINEER
ASSISTANT PRODUCTION SUPT.
TECHNICAL OFFICER
WORKS CHEMIST
TEST ENGINEER
ASSISTANT PLANNING SUPT.

in rubber and plastic cable factory being erected at Poona, near Bombay. Remuneration commensurate with age, experience, qualifications and ability of selected candidates.

Closing date for application 13th June, 1960. Apply—Box 4692.

HEATING ENGINEER

for leading manufacturers of electric floor warming system. Grad. I.H.V.E. minimum standard of qualification with experience in heat loss and design calculations. Scope and prospects in expanding organisation for individual with initiative and having electrical bias.

Full details stating salary required to Box 4766.

REPRESENTATIVES

OLD-established manufacturers of distribution equipment and accessories will be appointing Representatives for

(a) LONDON.
(b) SOUTHERN COUNTIES.
(c) MIDLANDS.

Exceptional scope for successful candidates who will receive training. Age 25/30, and must be men with good education and personality.

Fullest details in strict confidence to—Box 4754.

THE STEEL COMPANY OF WALES LTD.

Velindre Works, Morriston, Swansea

APPLICATIONS are invited for the following appointment in the Electrical Engineering Department of a modern tinplate works.

JUNIOR ELECTRICAL ENGINEER. A graduate, aged not more than 28, is required for this post. Suitable training will be provided, but a knowledge of steelworks control systems would be an advantage. This industry offers considerable scope for men of the required calibre. A contributory pension scheme is available.

Applications stating age, experience and qualifications should be sent, not later than 20th June, to :—

The Chief Electrical Engineer
THE STEEL COMPANY OF WALES LTD.
Velindre Works, Morriston, Swansea

4755

ELECTRICAL CONTRACTORS

have the following vacancies in their Manchester Office:

(a) SENIOR DESIGN ENGINEER capable of working without supervision and having a wide experience in the design of lighting and power installations, control and instrumentation cabling on large industrial and commercial projects.

(b) ESTIMATING ENGINEERS of proved ability in the preparation of detailed estimates for all classes of installation and cabling work, both in this country and overseas.

Applications in own handwriting, stating age, educational background, qualifications, experience and salary required to :—

The Manager
DRAKE & GORHAM (CONTRACTORS) LTD.
21, Newton Street, Manchester, 1

4756

CENTRAL ELECTRICITY GENERATING BOARD

South Eastern Division

GENERAL ASSISTANT ENGINEER (Chemist), CROYDON "A" and "B" GENERATING STATIONS (Vacancy No. 126/60).

Applicants should have had experience in the analysis of coal, water and oil and should preferably hold O.N.C. (Chemistry).

Salary N.J.B. Class K, Grade 18, £600-£645 per annum, including London allowance.

Applications, giving age, details of qualifications, experience, etc., to Station Superintendent, Croydon "B" Generating Station, Beddington Farm Lane, Croydon, Surrey, to arrive by 17th June, 1960.

W. H. DUNKLEY,
Divisional Controller.

4740

ELECTRICAL ENGINEER

required by

BRITISH HYDROCARBON CHEMICALS LIMITED

at their works at Grangemouth. Minimum qualifications Higher National Certificate. The salary will be in accordance with age and experience, and there is a non-contributory pension scheme in operation.

Replies, in writing, to the Administrative Officer, British Hydrocarbon Chemicals Ltd., Bo'ness Road, Grangemouth. 4612

HEREFORDSHIRE COUNTY COUNCIL

ASSISTANT ELECTRICAL ENGINEER required. A.P.T. Grades II (£765 to £880), III (£880 to £1,065) or Special Scale (£785 to £1,070) according to ability, experience and qualifications. Car allowance. Drawing board experience essential. Varied programme of large and small installations in schools and public buildings. Five-day week.

Superannuated post, subject to medical examination and one month's notice either side. Separation allowance to married men for limited period in certain cases (25s. per week and fare home every two months).

Hereford is situated in the beautiful Wye Valley.

Application forms from County Architect, Bath Street, Hereford, to be submitted by 15th June, 1960. 4620

AREA SALES MANAGERS

APPLICATIONS are invited for the position of Area Sales Managers particularly for the London and Home Counties.

Applicants should have had previous experience of selling Electricity Meters to Area Boards and have contacts at all levels.

There is a contributory pension scheme and a car is provided.

Applications, which will be treated with strict confidence, giving full details as to age, training, experience and salary expected to be addressed to C. R. F. Taylor, Smith Meters Limited, Rowan Road, Streatham Vale, London, S.W.16. The envelope to be endorsed "A.S.M."

4587

LARGE HOTEL COMPANY

have a vacancy on their electrical side for an ASSISTANT, aged 30-35, capable of advising upon, specifying and directing installations, mostly lighting and heating, but including ventilation, refrigeration, lifts and all the electrical items in a modern hotel.

Based on London, there would be travelling throughout the country.

Pension and life assurance scheme.

Write stating age, experience and salary desired to—Box 4694.

TECHNICAL ASSISTANT

required by

LEADING SOUTH STAFFORDSHIRE STEELWORKS

Minimum qualification H.N.C. Experience required in A.C. and D.C. control and distribution gear, lighting, cabling and preparation of specifications.

This appointment is a senior position with a good commencing salary and the successful applicant will be responsible for electrical improvements, development and drawing and engineering office management.

Applications stating age, experience and salary required to Box 4658 by 18th June, 1960.

DRAUGHTSMEN REQUIRED BY LIGHTING EQUIPMENT MANUFACTURER

A GOOD opportunity for young draughtsmen arises in the London office of a well-known and established manufacturer of a variety of specialised lighting fittings. Some works experience or training preferred.

Convenient to Victoria and Waterloo stations. 5-day week, contributory pension scheme.

Write fully to—Box 4753.

ELECTRIC MOTOR CONTROL

ENGINEERS

required by West Midlands manufacturers for their

APPLICATION ENGINEERING DEPARTMENT

at their main works.

Removal expenses met in approved cases.

Write Box No. 4731, giving age, experience and salary required.

JUNIOR ELECTRICAL ENGINEER

THE WELDLESS STEEL TUBE Co. Ltd., Wednesfield, wish to recruit a Junior Electrical Engineer for work embodying electrical control and other aspects of development related to plant automation.

Applicants, aged between 25 and 30, should be preferably graduates or have reached at least H.N.C. standard in electrical engineering. They should have a sound knowledge of modern automatic control gear, covering all developments in the use of electronics, and be capable of preparing schematic diagrams and following through developments from initial conception to final commissioning.

A good salary will be paid, related to the qualifications and experience of the individual appointed. Staff conditions include a life assurance and contributory superannuation scheme.

Those interested are asked to write in confidence to the Chief Engineer, The Weldless Steel Tube Co. Ltd., Wednesfield, Staffs.

4565

SENIOR DRAUGHTSMAN

required by London manufacturer, to assist in the design of electrical appliances. Applicants should have H.N.C. or equivalent and be experienced in the design of f.h.p. motors.

Please write giving full details of qualifications and experience. All replies will be treated in strictest confidence. Applications should be addressed to the Managing Director.—Box 4693.

LONDON COUNTY COUNCIL

HACKNEY TECHNICAL COLLEGE, Dalston Lane, London, E.8, requires, September 1960, suitable qualified evening Teachers for following subjects :—

NATIONAL CERTIFICATES:
Principles of Electricity (S.1).
Heat, Light and Sound (S.2).
Engineering Science (S.1, S.2).
Engineering Science—Electrical (S.2).
Electrical Technology—A.C. (S.3).

RATES OF PAY (2¼ hours): S.1, S.2, 46s. 3d.; S.3, 58s. 3d.

Applications (no forms) to Secretary, stating age, qualifications, industrial experience, teaching experience (if any), and evenings available from 7 to 9.15 p.m. (1369) 4710

TESTERS (ELECTRONICS)

VACANCIES now exist for men with practical experience on electronic test work on equipment similar to data processing equipment. Qualifications up to approximately O.N.C. are desirable.

HOUSING FOR RENTAL MAY BE MADE AVAILABLE.

Please apply with full details to the Personnel Officer, A.E.I. Instrumentation Division, P.O. Box 1, Harlow, Essex.

4727

A WELL-established company manufacturing transformers in Southern England are seeking a senior and junior assistant for their H.V. laboratory. The senior assistant should have passed his H.N.C. or equivalent and have some experience of testing, preferably impulse testing. The junior assistant should be studying for his H.N.C. and have some transformer test experience. Applications in writing, stating age, education, qualifications, experience and salary required to—Box 4721.

BRITISH ENGINE BOILER & ELECTRICAL INSURANCE Co. Ltd., Longridge House, Manchester, 4. Electrical surveyors required in Ireland and Scotland. Permanent positions carrying progressive salary scale £800 to £1,100 and non-contributory pension. Candidates, aged 26 to 32, with H.N.C. in Electrical Engineering or Grad. I.E.E., and with apprenticeship in manufacture or repair of electrical machinery, are invited to apply stating age, qualifications and experience. 4703

ASSISTANT supervisor with estimating experience required by electrical contractor. Apply in writing stating experience, salary required, etc., to—Waring, Withers & Chadwick Ltd., 40, Hatton Garden, London, E.C.1. 4575

ASSISTANT electrical engineer required by national newspaper. Age 25/26. Electrical apprenticeship and Higher National. Must be first-class electrical draughtsman. Good prospects.—Box 4696.

ASSISTANT electrical engineer required for a group of brick works in the Peterborough area. Applications are invited from men, aged 35 to 40 years, who have served an apprenticeship and hold at least H.N.C. in Electrical Engineering. Applicants should have first-hand experience of installation for power and lighting; E.H.T. and M.V. distribution and the operation and maintenance of works and quarry plant. Apply, stating salary required, to the Personnel Manager, London Brick Company Limited, Stewartby, Bedford. 4680

BRYCE ELECTRIC CONSTRUCTION Co. Ltd. have vacancies for senior and junior power capacitor and transformer development engineers. Write Chief Engineer, Bryce Electric Construction Co. Ltd., Kelvin Works, Hackbridge, Surrey, stating age, experience, qualifications, and salary required. 4321

CONSULTING engineers require engineer for inspecting, testing and reporting on electrical installations in factories, commercial buildings and petroleum installations in the British Isles. Experience of flameproof installations essential. Holiday arrangements honoured. Write stating details of experience to—Box 4681.

CONSULTING engineers require intermediate draughtsmen, designers and junior draughtsmen for electrical services in connection with hospitals, university projects and schools. Write — Locke & Beal, 303/307, Balham High Road, London, S.W.17. 4495

CONTROL circuit engineer and estimator for automatic motor control gear; O.N.C. or H.N.C. desirable with previous experience; permanent and pensionable situation. Apply giving details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey. 129

CROMPTON PARKINSON Ltd. require a senior transformer designer for their Hayes works, Middx. Applicants should have degree or H.N.C. and preferably some years' experience with transformers up to 20,000 kVA and 66 kV, with on-load tap changing gear. Write with full particulars of age, education, qualifications and salary required to the Personnel Officer, Clayton Road, Hayes, Middx. 4682

DRAUGHTSMAN (junior) electro/mechanical; interesting situation with excellent prospects. Apply giving full details of age, experience and present salary, to—The Managing Director, British Klockner Switchgear Ltd., Chertsey, Surrey. 130

DRAUGHTSMAN required by manufacturers of medium-voltage metalclad switchgear for their contracts drawing office. Bonus and non-contributory superannuation schemes in operation. The company is within six miles of the South Devon Coast, and a house is available for the selected applicant. Write, stating previous experience, age, and salary required, to — Ottermill Switchgear Limited, Ottery St. Mary, Devon. 4554

DRAUGHTSMAN required for consulting engineers' office, to assist in the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experience, present salary and salary required to — J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 4767

DRAUGHTSMAN required for switchboard layout. Over 21 years. 5-day week. Pension scheme. A.E.S.D. rates.—Auto Diesels Ltd., Uxbridge (Tel. Uxbridge 8262). 4683

ELECTRICAL draughtsman. A good opportunity is open for a man of above average capability with a firm of consulting engineers in London to undertake the preparation of design, drawings and specifications for power lighting installations covering all types of commercial and industrial buildings. Good salary offered to the right man. Write in the first instance stating age, salary and experience to—A. F. Myers & Partners, 147, Victoria Street London, S.W.1. 4576

ELECTRICAL contractors require an estimator for industrial and commercial installations. Only fully experienced men who are conversant with all types (including FLP) need apply. Please write stating experience, qualifications and salary required to—Box 4622.

ELECTRICAL design engineer required to work with minimum supervision on interesting power and lighting schemes for major building projects. H.N.C. level of ability required. Apply in writing giving full details of age, experience and salary required to—Norman & Dawbarn, Architects & Consulting Engineers, 7, Portland Place, London, W.1. 131

ELECTRICAL engineer required for consulting engineers' office, to carry out the design of lighting and power installations for all classes of buildings. Five-day week. Spring and summer holidays. Pension scheme and luncheon vouchers. Apply in writing, stating age, experence, present salary and salary required to — J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 4768

ELECTRICAL engineer required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler & Electrical Insurance Co. Ltd., 98, West George Street, Glasgow, C.2. 4702

ELECTRICAL engineering assistants required with experience in preparing specifications for new electrical installations in buildings. For those obtaining H.N.C. (Elec.) prospects of advancement in entry grade to maximum of £1,135 (under review, will probably become £1,250). Pension scheme. Staff restaurant. One Saturday only worked in five. Form from Chief Engineer (GS/ER/1318/6), County Hall, London, S.E.1. 4697

ELECTRICIAN for Works Dept., St. Marylebone Borough Council. Wages at electrical contracting industry rates, present 5s. 3½d. per hr. (£11 12s. 10d. 44-hr. wk.). Superannuation scheme. 5-day wk. on trial period. Staff canteen. Experience necessary maintenance A.C. motors, light and power installations, Pyrotenax wiring systems and screwed conduit, battery charging and testing. Write stating age and experience, with copies of 2 recent testimonials, to Borough Engineer, Town Hall, St. Marylebone, London, W.1. 4722

ESTABLISHED electrical engineering concern engaged in manufacturing and depair of electric motors and transformers require qualified electrical engineers for staff appointments in United Kingdom. Age limit 37. Good conditions. Applications stating training, qualifications, experience, present position to—Box 4757.

H.T. and L.T. cable jointers required for work in Southern England.—Box 7543.

JOINTER (extra high tension) required. Present rate of pay 5s. 1¾d. per hour. N.J.I.C. conditions. 42-hour 5-day week. Holiday, sick pay and optional superannuation schemes. Apply by letter, within 14 days, stating age, experience and present position to District Manager, Midlands Electricity Board, Gaolgate, Stafford. 4698

LABORATORY technician required for the electrical and mechanical laboratories and to give some assistance in the workshops. O.N.C. or C. and G. qualifications desirable. Salary £525-£655 (A.P.T.C. Misc. III/IV). Local Government conditions and superannuation; 3 weeks holiday per annum. Facilities for further education. Apply—Principal, South Herts College, Wood Street, Barnet. 4699

LIGHTING sales engineer required for Scotland; reside Glasgow or Edinburgh. Industrial and commercial lighting sales experience necessary. I.E.S. diploma an advantage. Reply with full details to—Ref. S3V, Crompton Parkinson Limited, Crompton House, Aldwych, London, W.C.2. 4684

REPAIR shop motor winder, A.C. and D.C., good general knowledge of the trade also required. Excellent prospects in small, well-established business, 25 miles west of London. —Box 4577.

REPRESENTATIVES required calling on wholesalers and retailers for most competitive distributors in the trade. Accessories, lamps, fittings and appliances. Only top-rate men with electrical trade connections need apply. —Universal Distributing Co. Ltd., 66/68, Great Eastern Street, London, E.C.2 (Phone, SHOreditch 8282). 4415

Situations Vacant (continued)

REPRESENTATIVE required by electrical wholesalers, London area, salary, commission, car allowance.—Box 4665.

SALES engineers. Young engineers over 21 years required for indoor staff of sales department. Technical and works training in electrical engineering practice, at least to O.N.C. standard, is required by West London engineering company specialising in explosion-proof and industrial electrical control gear as well as other electrical equipment for industry. Candidates, in replying, should state age, training, qualifications and anticipated remuneration, in confidence, to—Box 182.

SALES executive, motor accessory manufacturers including wholesalers (Midland area only). Must be used to negotiating motor bulb business at directors' level and based on Birmingham area. Age early thirties. Apply giving full particulars age, education, references, present and anticipated salary to—Rival Lamps Ltd., Weybridge, Surrey. 4723

SALESMAN required to take charge of a retail electrical shop run by old-established city (London) contractors.—Box 4666.

SENIOR and junior electrical design engineers/draughtsmen required for consulting engineers' office. 5-day week, luncheon vouchers, spring and summer holidays. Applicants for senior positions must be experienced in design of electrical services for modern hospitals, universities, factories, etc. Please apply stating age, experience and salary required to—J. Stinton Jones & Partners, 21, Gloucester Place, London, W.1. 185

SITE foreman required for industrial contract in North of England. Must be fully experienced. Write—W. J. Furse & Co. Ltd., 22, Alie Street, Aldgate, London, E.1. 4529

SPECIFICATION writer/engineer. A vacancy exists with Sangamo Weston Ltd. at Enfield for a young man having a light electrical engineering background and educated to H.N.C. (Electrical) standard. Work entails preparation of specifications of electrical measuring instruments to meet customers' requirements and liaison between development laboratories and contracts department. Write giving full particulars of experience, etc., to the Personnel Manager, Sangamo Weston Ltd., Cambridge Road, Enfield, Middx. 4616

STOREKEEPER required, only first-class applicants with substantial experience in electrical wholesaling will be considered. More than average salary is offered in return for ability and efficiency. Permanent superannuated post for right man desirous of progress. Canteen available.—Halsey's, Fulham 3355. 156

SUPERVISOR. Established electrical contractors N.W. London require supervisor capable of estimating for and carrying through contracts for industrial and public authority work. Contributory pension scheme. — Box 4625.

TEACHER for electrical engineering subjects to teach mainly electrical installations work with some electro-technology for the Ordinary National Certificate scheme. Candidates to have National Certificate or City and Guilds qualifications. Salary Burnham Technical Scale, Grade A, £520 by £27 10s. to £1,000 per annum, plus London weighting. Applications (no forms) should be sent with the names of two referees and not more than two testimonials to the Principal, South Herts College of Further Education, Wood Street, Barnet, Herts. 4700

TECHNICAL assistant (lighting) required, capable of designing all classes of gas and electric lighting installations. Good technical groundwork in illuminating engineering and some experience in practical application. Technical qualifications an advantage. Commencing salary £875 rising to £948. Apply giving details of experience, etc. (quoting reference ER) to—Chief Civil Engineer, British Railways, Southern Region, Waterloo Station, London, S.E.1. 4676

TECHNICAL representative required by manufacturers of transmission line accessories. Technical knowledge and good connections with the electricity boards essential. He must be prepared to travel extensively throughout the British Isles. This is a growing concern and offers an opportunity to join in at an early stage of development. Salary commensurate with the position. Car provided. Write in the first instance with full details of experience to—Sales Manager, Preformed Line Products (Great Britain) Ltd., Andover, Hants. 4758

WELL-known electrical instrument manufacturer in the North-West requires technical assistants with N.C. or H.N.C. level of education. Salary according to experience. Contributory pension scheme in operation. Apply stating age, experience and qualifications to—Box 4701.

YOUNG man required to maintain electrical and electronic test equipment. Some experience necessary; further training will be given to suitable applicant. Write stating age, experience and present wages to.—Box 7546.

SITUATIONS WANTED

TECHNICAL SALES ENGINEER, knowledgeable East, South, West Africa, normally resident Nairobi, keen join manufacturer view post U.K. or overseas; 45, public school, university, workshop and excellent sales record light/heavy electrical plant, domestic appliances, etc. Interviews U.K.—Box 7529.

ARE you seeking a first-class salesman, or agent of many years' experience? Strong connections with wholesalers, boards, in London and Home Counties, also West Country.—Box 7544.

ELECTRICAL-mechanical engineer with many years' experience on large power stations and systems, specially hydro-electric. Specialist on construction, maintenance and preventative maintenance. Seeks further employment anywhere. Recently six years in India. Good references.—Box 7548.

EXPERIENCED young man seeks position with sound prospects as manufacturers' representative. Specialities moulded circuit-breakers and switchgear. Conversant with all aspects of the industry.—Box 7545.

WINDING shop manager/foreman, experienced all types rewinds/repairs A.C./D.C., production or repair shop, controlling winders, fitters and maintenance engineers, desires supervisory position good prospects.—Box 7539.

APPOINTMENTS FILLED

Dissatisfaction having so often been expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

ARTICLES FOR SALE

MERCURY ARC RECTIFIER

ELECTRIC CONSTRUCTION Company Mercury Arc Rectifier, portable equipment. Input 415 volts, 3-phase, 50 cycles, output 70 kW, 220 volts D.C.

WHITEFIELD MACHINERY & PLANT LIMITED
48, Chatham Street, Edgeley Hill
Stockport, Cheshire
Telephone: Stockport 4471

4583

ELECTRIC HOUSE SERVICE METERS

PREPAYMENT and credit, 200/250 v. A.C., s/p., 50 c., 2½-100 A. Fixed or variable tariff. Reconditioned, fully tested and guaranteed 2 years. Prompt delivery, carriage paid.

ALBERICE METER COMPANY
87/89, Sterte Avenue, Poole, Dorset
(Tel.: Poole 272)
371, West Green Road, Tottenham, London, N.15 (Tel.: Bowes Park 7080) 191

HOUSE SERVICE METERS

200-240-v. A.C. or D.C., 10 amps. capacity, quarterly type, from 25s. each, plus 2s. 6d. carr.

UNIVERSAL ELECTRICAL CO.
221, City Road, London, E.C.1 37

A.A. ELECTRICAL Co. for A.C.-D.C. motors, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—CHI. 5105. 67, Rothschild Rd., London W4. 57

A BABCOCK & Wilcox water tube boiler will cut down your fuel costs; we can supply from stock. Two 40,000 lb. evap., 220 lb. w.p.; one 25,000 lb. evap., 200 lb. w.p.; 3,000 lb. evap., 400 lb. w.p.; Spencer Bonecourt boiler; also Marine, Cornish vertical, etc.—Burford, Taylor & Co. Ltd., Boiler Specialists, Burtayco House, Church Street, Middlesbrough (Tel. Middlesbrough 2622). 122

A.C. and D.C. 1/- slotmeters. Guaranteed 2 years, 2½-50 amps. From 55/-. Repairs and recalibrations. See Billiard: Tradex Meter Co., Surbiton (Tel. Elmbridge 2234/5/6). 169

A.C. and D.C. motors, generators, from stock.—Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. (Edgware 5566/9). 91

ALTERNATORS and generators, all types up to 150 kW.—Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 151

ALTERNATORS, 3-phase, all sizes in stock from 7 kVA up to 330 kVA.—Britannia Manufacturing Co. Ltd., 20/26, Britannia Walk, London, N.1 (CLErkenwell 5512). 24

BARGAINS in electric motors from A. Cooksley & Co. Ltd., 21/25, Tabernacle Street, London, E.C.2. Ring Monarch 3355. 50

BILLIARD Meters. 1/-, 6d. or 1d. slot. All time settings. From 170/-. See Quarterly.—Tradex, Surbiton. 170

CABLE, underground, all types ex stock.—E. M. Tatton Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 117

CABLE, underground, PILC/VIR/LC, ex London stock. Cutting orders same day delivery London area. Send for priced stock lists. — Batt Electrical Co., 6, Dock Street, London, E.1 (Tel. ROYal 5905). 316

CIRCUIT breakers, various sizes in stock, A.C. and D.C., 200 amperes up to 2,000 amperes. Also dynamo and alternator switchboards. — Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 26

CONVERTERS, motor-alternators, motor-generators, frequency changers, etc. All types up to 100 kW.—Powerco Ltd., 312, York Rd., London, S.W.18 (VAN. 5234). 150

CRANE motors. Direct current, series wound or compound wound, all voltages. We have large stocks.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 22

CROMPTON Parkinson control panel. With oil-immersed draw-out truck-type circuit-breaker. 3.3 kVA, 500 A. Over load trips with time delay. 0-4,000 voltmeter. 0-600 ammeter. Perfect condition (2 available).—Speed Electrics, Dept. ER., Church Street, Basford, Nottingham. 4669

DIESEL generating sets, all sizes to 500 kW. Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 16

ELECTRIC motors, dynamos, alternators and motor generator sets of all sizes. We hold one of the largest stocks in England. New and reconditioned, with 12 months' guarantee.—Britannia Manufacturing Co. Ltd., Britannia Walk, London, N.1 (Clerkenwell 5512, 3 lines); also Works and Stores, Chobham, Surrey. 20

ELECTRIC motors and generating equipment.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4534/5). 116

ELECTRIC motors, generators, control gear, transformers, A.C. and D.C., new and reconditioned; all covered with our usual 12 months' guarantee; large stocks available.—Electropower Co. Ltd., Kingsbury Works, Kingsbury Road, London, N.W.9 (Colindale 4621-2). 42

ELECTRIC motors, generators, motor generator sets, transformers, switchgear, etc., large comprehensive stock, overhauled and guaranteed. Copy of our Register, "Electrical Surplus," containing thousands of items of electrical plant, sent on request.—R. F. Winder Ltd., Belgrave Electrical Works, Leeds, 2. 54

ELECTRICIANS. Send for details Shaftesbury lightweight "Bantam" ladders. Top sections fitted with patent moulded rubber blocks, eliminate possibility of scratching or marking walls, fascias, and other painted or highly polished surfaces. Also available for immediate delivery, steps, platform steps, trestles, telescopic trestles, pole and builders-type ladders, and all sizes of two and three-section extension ladders.—Shaftesbury Ladders Ltd. (E.R.), 453, Katherine Road, London, E.7 (Phone: Grangewood 3363/4). 111

FOR sale. Quantity industrial iron clad voltmeters by Crompton Parkinson, size 3" 0-300 and ammeters 0-30 for A.C. supply. Tested and in good order. 70s. a pair. Also 4" voltmeters 0-300 by E.A.C. 47s. 6d. each.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts. 4761

FLUORESCENT tubes reconditioned and guaranteed with a life as new for 7s. 6d. each. Free collection and delivery in Lancs and Yorks. Save 40% on your tube replacement costs by using this service. We are also manufacturers of top quality fluorescent fittings, trunking systems, control gear and new fluorescent tubes. Generous discounts available.—Anglo-American Electrical Company, Olive Street, Bury (Telephone, Bolton 7251). 212

FOR sale, good, unused and used machinery, including electric motors, A.C. and D.C., dynamos, alternators, transformers, diesel and steam electric generating sets, mains failure sets, motor generator and Ward Leonard sets, switchgear, compressors, fans, capacitors, etc.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts (Tel. B.S. 1000/1). 161

GENERATING sets, portable or stationary, new and reconditioned, 1 to 100 kW, A.C. and D.C. — Powerco Ltd., 312, York Road, London, S.W.18 (VAN. 5234). 148

KARDEX, Roneodex and Shannovue cabinets, as new.—F. H. Jolly & Co. Ltd., 289, King St., London, W.6 (RIV. 5381). 202

MOTOR generator sets and converters, all sizes and voltages from ½ kW up to 500 kW in stock. — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, City Road, London, N.1 (Tel. Clerkenwell 5512, 5513 & 5514). 12

MOTORS and control gear, huge stocks all types, ¼ to 200 h.p.—Ramsbottom & Co. Ltd., Elec. Engineers, Keighley (3774/5/6). 70

NAMEPLATES, engraving, diesinking, stencils. — Stilwell & Sons Ltd., 153, Far Gosford Street, Coventry. 108

PHASE converters, single to three-phase, several sizes in stock up to 90 h.p., 3-phase loading. — Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 29

PLATING dynamos and motor generator sets, various sizes from 500 amps. up to 2,000 amps., with A.C. and D.C. motors.— Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 15

POLYPHASE kilowatt hour meters. Available from stock.—Universal Electrical, 221, City Road, London, E.C.1. 40

PREPAYMENT 1s. slot house service meters. —Universal Electrical, 217-221, City Road, London, E.C.1. 36

PURLEY chokes and ballasts. Our 80-w. tapped h.p.f. ballast with starter switchholder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s. 6d. each subject.—F. F. Blanshard Ltd. (Dept. ER), Purley, Surrey (Uplands 4818/9). 52

QUARTERLY credit meters, single and polyphase, 2½-100 amps. From 20/-. Also D.C. See Television.—Tradex, Surbiton. 171

ROTARY converters in stock, all sizes; enquiries invited. — Universal Electrical, 221, City Road, London, E,C.1. 34

SMALL BR screws and nuts in steel, brass and stainless steel, from stock.—Premier Screw & Repetition Co. Ltd., Woodgate. Leicester. 180

TELEVISION slotmeters and time switches. Details from : Tradex Meter Co., Surbiton (Elmbridge 2234/5/6). 172

VENNER time switches, 200-240 v., A.C./D.C., 10-50 amps., from stock.—Universal Electrical Co., 221, City Rd., London, E.C.1. 38

WARD Leonard motor generating sets, all sizes.—Britannia Manufacturing Co. Ltd., 22-36, Britannia Walk, London, N.1 (Tel. Clerkenwell 5512). 10

2 Ruston & Hornsby 550-h.p., 500-r.p.m., 6VEBX supercharged oil engines, as new and perfect. Coupled to 375-kW, 110-v. D.C. generator with panel. Can be adapted to A.C. or any voltage.—E. M. Tatton & Co. Ltd., Kew Bridge, Brentford (ISLeworth 4466). 4627

2-speed motor, 40/20 h.p., 950/480 r.p.m.. T.E.F.C. slipring type by L.D.C. with Igranic automatic control panel. Further details from— Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 78

180-h.p., 970-r.p.m. T.E.F.C. slipring motor by Lancashire, 400 v., 3-phase. 50 cycles, complete with fully automatic starting panel. Further details from—Dynamo & Motor Repairs Ltd., North End Road, Wembley Park. 77

500-kW, 220-volt Met.-Vick. rotary converter, with transformer, 11,000 volts, 3-phase, 50 cycles, and accessories.—Britannia Mfg. Co. Ltd., Britannia Walk, London, N.1. 17

400-cycle to 1,500-cycle motor alternators and alternators.—Britannia Mfg. Co Ltd., Britannia Walk, London, N.1. 27

500/625-kW L.D.C. generator, 240 volts, 2,080/2,600 amps., D.C., compound interpole with single bearing for direct coupling at 1,000 r.p.m., or on combination bed with new L.D.C. slipring motors, 900 h.p., 990 r.p.m., 3.3 kV or 6.6 kV, complete with switchgear, in approximately six months. Also duplicate generator and spare armature. Further details from Dynamo & Motor Repairs Ltd., North End Road, Wembley. 84

EQUIPMENT FOR HIRE

GENERATING set hire service. Consult the most experienced firm for A.C. and D.C. units from 2 kW to 240 kW, diesel or petrol, stationary or mobile, sale or hire. 24-hr. breakdown service. — Dawson-Keith Ltd., Hillview Rd., Sutton, Surrey (Fairlands 4401). 46

ARTICLES WANTED

WANTED

D.C./A.C. Motors, Transformers, Cables and all redundant Power Station Plant wanted for dismantling.

ASK US TO QUOTE

B. M. T. CO. LTD.
London Road, Barking
(RIP. 3387/3715)

298

A.C./D.C. electric motors, generators, transformers, disused stocks of cable, power houses bought and dismantled.—Samuel Hyams, 129, Lambs Lane, Rainham, Essex (Rainham 4896). 125

HARRINGTON & Sons, reclamation contractors, want redundant A.C./D.C. electric motors and transformers, stocks of cable, etc.—109, Beaconsfield Street, New Beckton, East Ham, London, E.6 (ALB. 1388). 315

MERCURY (Quicksilver) wanted. Write for packing instructions. Gold, silver and platinum also purchased.—Collingridge & Co. Ltd., Riverside Works, Riverside Rd., Watford (Tel. 5963). 114

QUICKSILVER and beryllium copper scrap urgently required, best prices, prompt cash. Sterling Products Ltd. Edmonton 4541 PBX. 293

SILICON steel offcuts required.—Box 138.

WANTED, D.C. and A.C. ball-bearing motors, motor generator sets, dynamos and alternators. Full details to — Britannia Manufacturing Co. Ltd., 22-26, Britannia Walk, London, N.1. 13

WANTED for export. Self-contained generating sets, 50-100 kW, 400/440/3/50 supply. Must have had very little use. Send full particulars. Exporter—Box 4760.

WANTED for prompt cash, ferrous and non-ferrous scrap, also plant for dismantling. Buyers of secondhand machinery and plant for re-use.—W. & H. Cooper Ltd., 176, Brady St., Bethnal Green, London, E.1. 120

WANTED. One hand-operated auto transformer starter suitable for 13-h.p. motor, 420/3/50. Send full particulars and state tappings if known.—Fyfe, Wilson & Co. Ltd., Station Works, Bishop's Stortford, Herts. 4759

WANTED, rotary converters, any sizes.— Universal, 221 City Rd., London E.C.1. 35

WANTED stroboscope. Preferably Dawe type 1211, range 600-15,000. Also Cambridge fluxmeter.—Young, 154/156, Blackfriars Road, London, S.E.1 (WATerloo 3131). 4763

WANTED, surplus stock cable, all types and sizes. We can inspect.—Box 220.

9 and 10-kVA ex W.D. alternators wanted, B.T.H., G.E.C., 1,500 r.p.m.—Box 4762.

AGENCIES

BRITISH agents having large ramifications within the electrical field seek additional agencies from Continental manufacturers of electrical accessories, small domestic electric appliances, etc. Substantial references and ample finance available.—Box 119.

CABLE representative with long experience in Manchester and district requires agencies from firms manufacturing paper, rubber, P.V.C., grid contacts, or will consider operating on a commission basis.—Box 7547.

MANUFACTURERS of first-class, popular priced, electric blanket wish to appoint sole selling agent for U.K. Established selling connection in the domestic electrical trade essential. For further details write—Box 4764.

WORK WANTED AND OFFERED

A.C. and D.C. motor rewinds and repairs. Prompt service, fully guaranteed.—Edgware 5566/9; Service Electric Co. Ltd., Honeypot Lane, Stanmore, Middx. 92

PRODUCTION winding of armatures, stator, coils, transformers. Also special motors. Prompt and reliable deliveries.—Lewis Electric Motors Ltd., Moor Wks., Maidenhead, Berks. 194

BUSINESS PREMISES

PREMISES to let or sell; close to Dover Docks; 3,000 sq. ft. Suitable for storage, warehouse, etc. Would consider agency and distribution, preferably domestic product. Particulars—Box 4765.

TRADE MARK NOTICES

WRIGHT ELECTRIC MOTORS (HX) LTD. HALIFAX

wish to point out that in their advertisement for "Coated Abrasive Disc-type Surface Finishers" (Machines for Grinding, Polishing and Sanding), which appeared in the issues of 1st January and 20th May, 1960, the term "linishing" was incorrectly used in relation to such machines.

The term "Linisher" is the Registered Trade Mark of Messrs. Turner Machine Tools Ltd., of Birmingham, and the word "linishing" relates to machines of their manufacture alone.

4724

EDUCATIONAL

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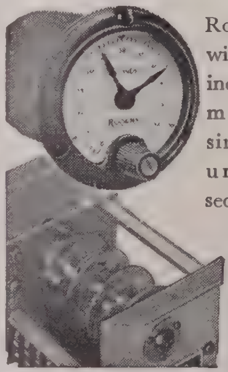

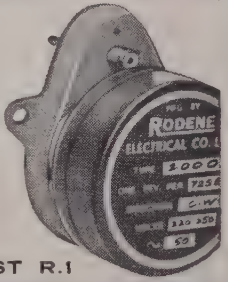

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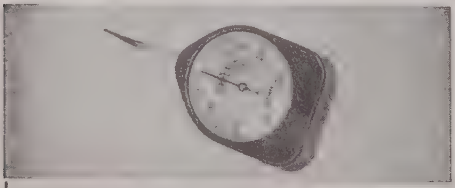

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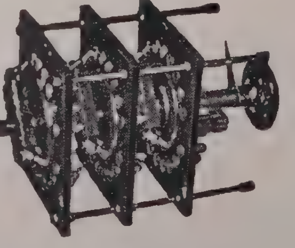

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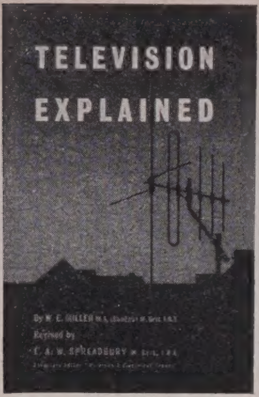

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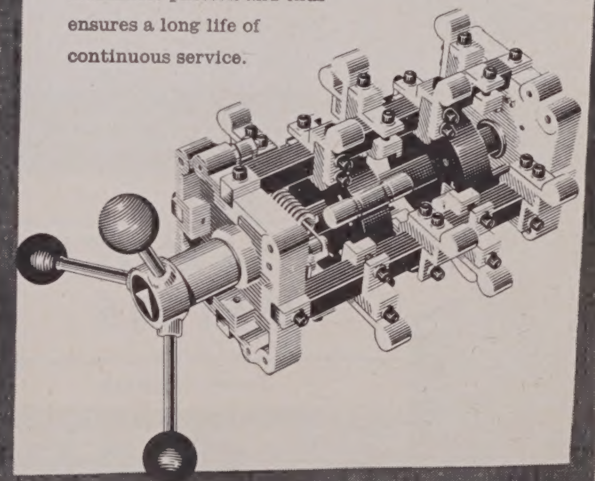

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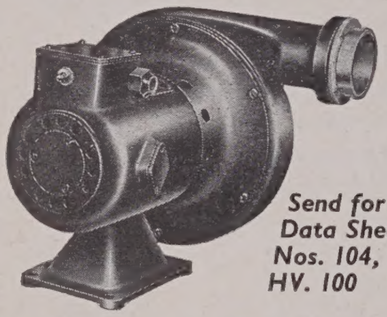

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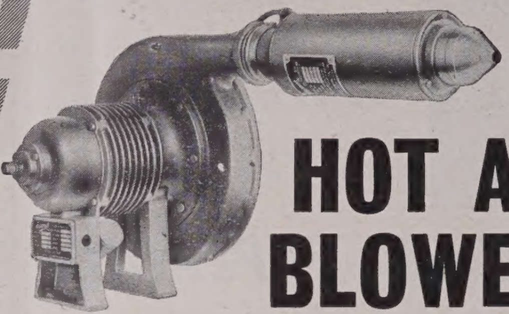

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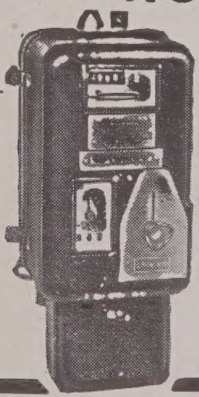

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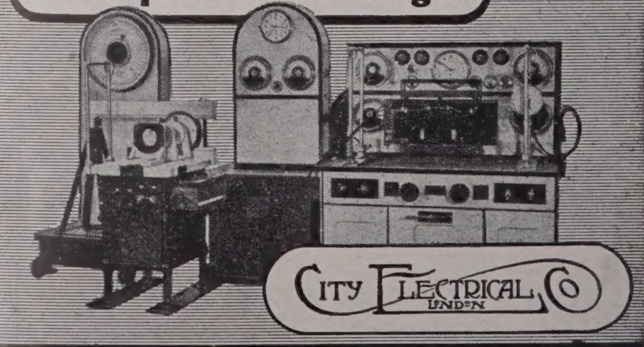

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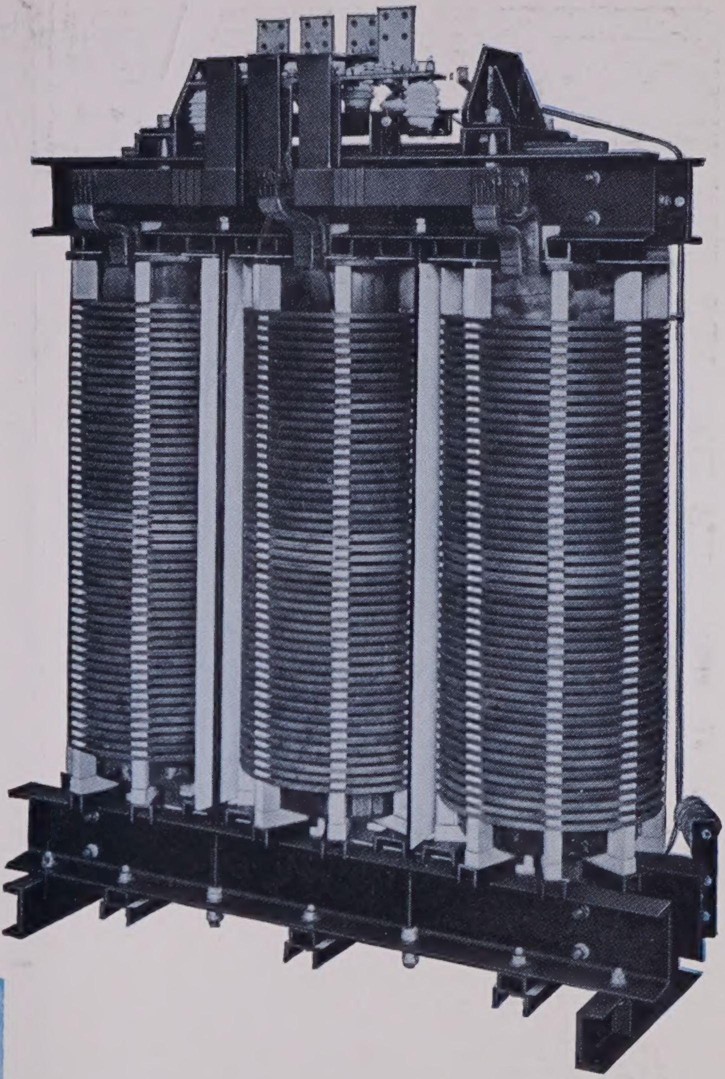

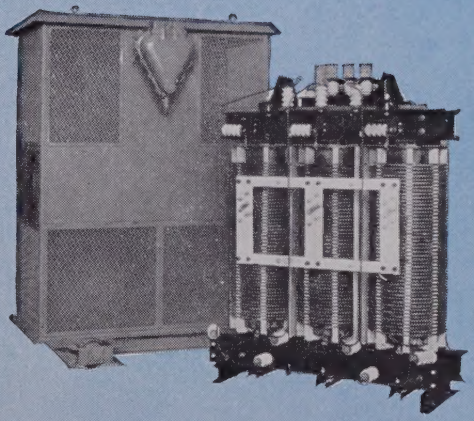

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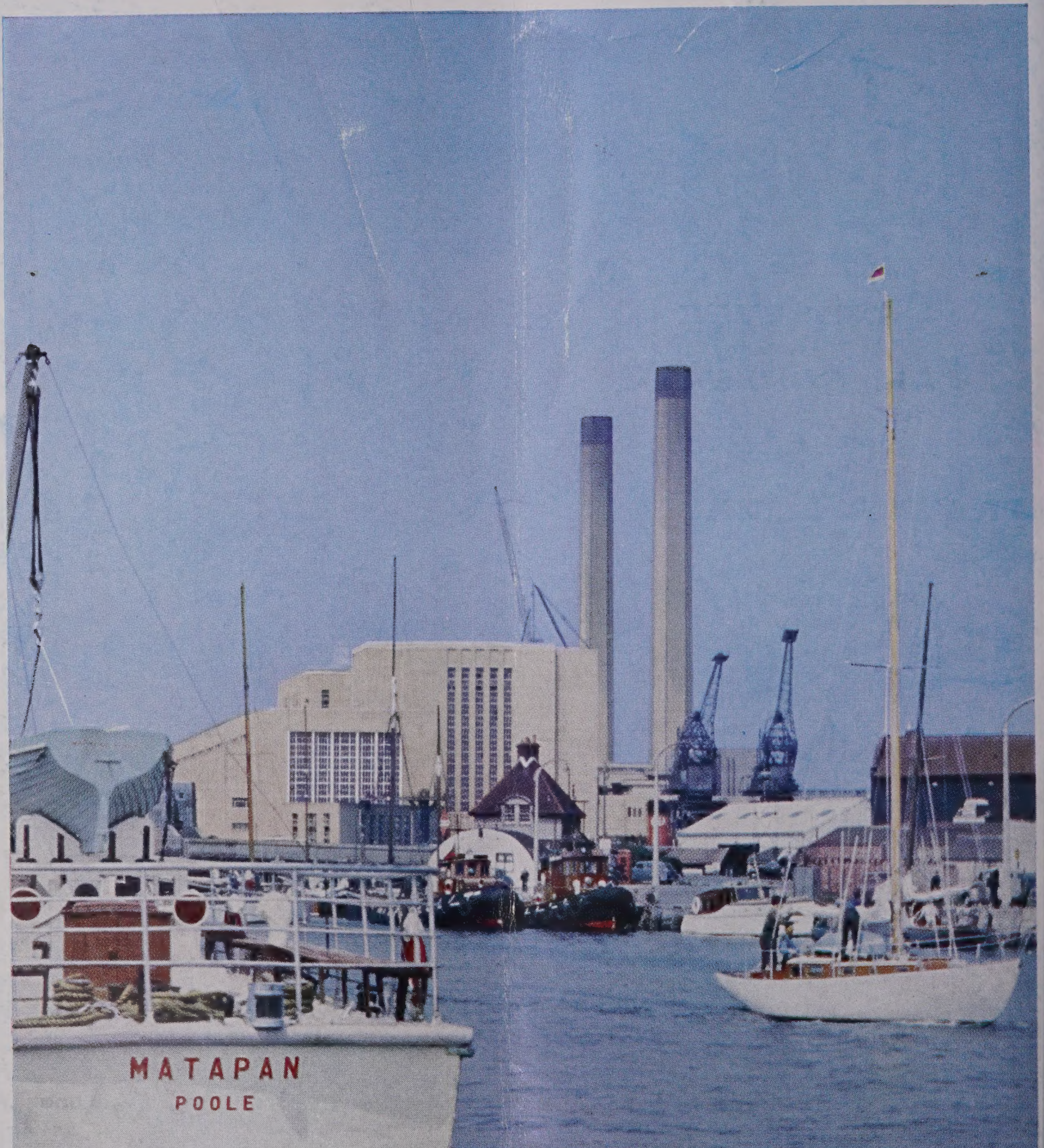

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